EPC2110 – Dual Common-Source Enhancement-Mode GaN Power Transistor

V_{DS} , 120 V

$R_{DS(on)}$, 110 mΩ

I_D , 3.4 A

EFFICIENT POWER CONVERSION

RoHS Halogen-Free

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.

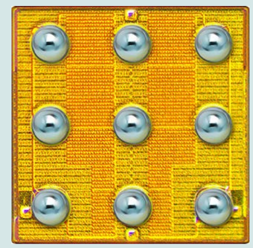
Maximum Ratings of Q1 & Q2

PARAMETER		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	120	V
I_D	Continuous (T_A = 25°C, $R_{\theta JA}$ = 52°C/W)	3.4	A
	Pulsed (25°C, T_{PULSE} = 300 µs)	20	
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 of Q1 & Q2

PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	25	
$R_{\theta JA}$	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



EPC2110 eGaN® FETs are supplied only in passivated die form with solder bumps
Die Size: 1.35 mm x 1.35 mm

Applications

- Ultra High Frequency DC-DC Conversion
- Wireless Power Transfer
- Synchronous Rectification

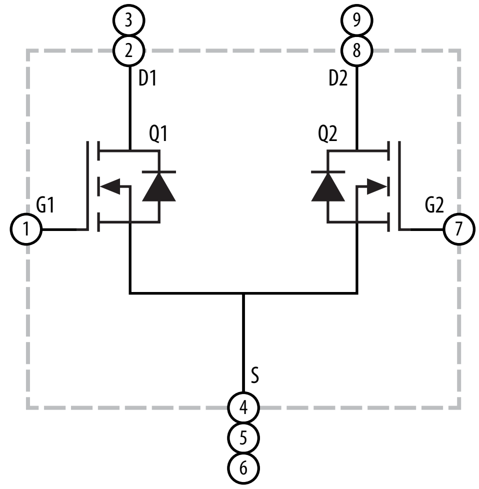
Benefits

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

www.epc-co.com/epc/Products/eGaNFETsandICs/EPC2110.aspx

Static Characteristics of Q1 & Q2 (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 = 0.3 mA	120			V
I_{DSS}	Drain-Source Leakage	V_{DS} = 96 V, V_{GS} = 0 V		0.01	0.25	mA
I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.05	1	mA
	Gate-to-Source Reverse Leakage	V_{GS} = -4 V		0.01	0.25	mA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.7 mA	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 4 A		80	110	mΩ
V_{SD}	Source-Drain Forward Voltage	I_S = 0.5 A, V_{GS} = 0 V		1.9		V



EPC2110 – Detailed Schematic

Note: The EPC2110 can be connected in parallel or used as independent FETs with common source.

Dynamic Characteristics of Q1 & Q2 (T_J = 25˚C unless otherwise stated)						
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	V_{DS} = 60 V, V_{GS} = 0 V		85	100	pF
C_{RSS}	Reverse Transfer Capacitance			1		
C_{OSS}	Output Capacitance			45	70	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{DS} = 0 to 60 V, V_{GS} = 0 V		54		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			67		
R_G	Gate Resistance			0.6		Ω
Q_G	Total Gate Charge	V_{DS} = 60 V, V_{GS} = 5 V, I_D = 4 A		0.8	1.1	nC
Q_{GS}	Gate to Source Charge	V_{DS} = 60 V, I_D = 4 A		0.25		
Q_{GD}	Gate to Drain Charge			0.18		
$Q_{G(TH)}$	Gate Charge at Threshold			0.16		
Q_{OSS}	Output Charge	V_{DS} = 60 V, V_{GS} = 0 V		4	6	
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 (Q1 & Q2): Typical Output Characteristics at 25°C

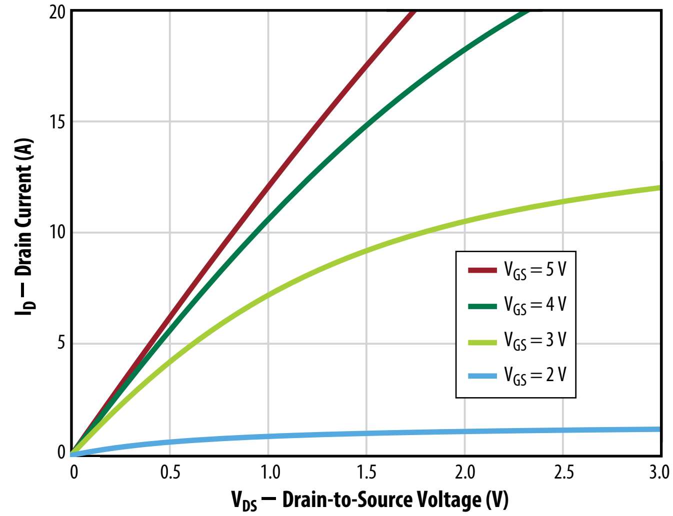


Figure 2 (Q1 & Q2): Transfer Characteristics

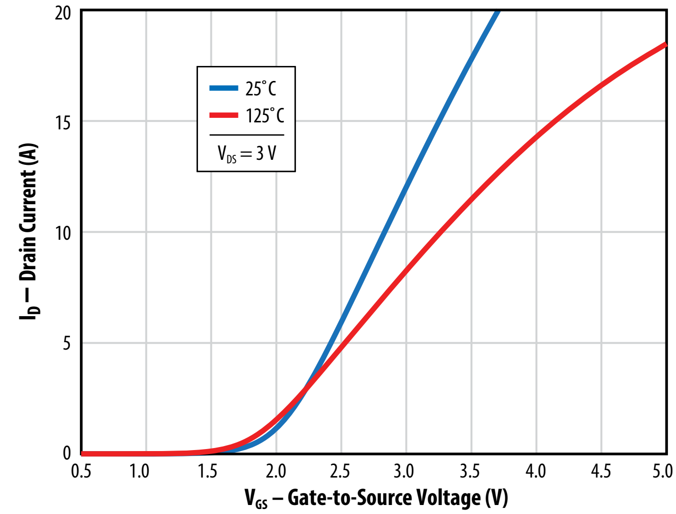


Figure 3 (Q1 & Q2): $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

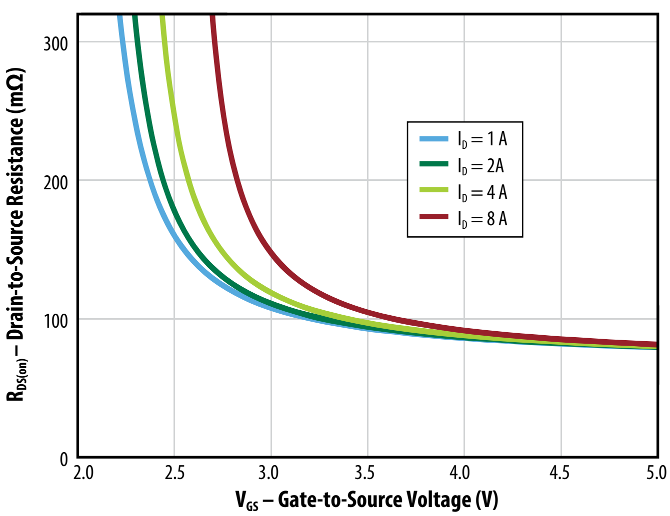


Figure 4 (Q1 & Q2): $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

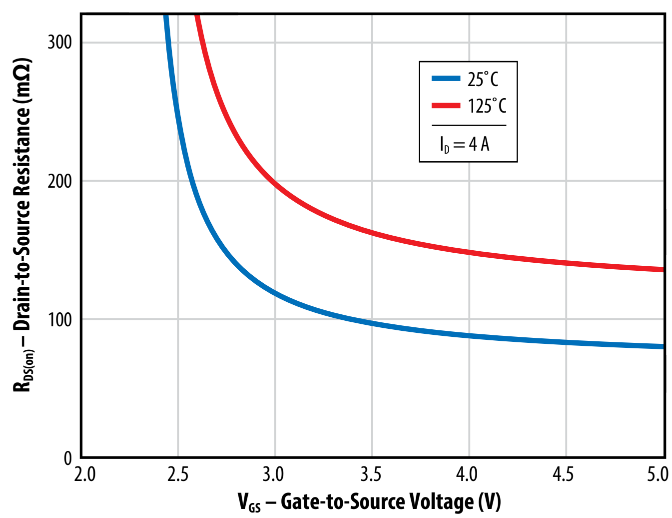


Figure 5a (Q1 & Q2): Capacitance (Linear Scale)

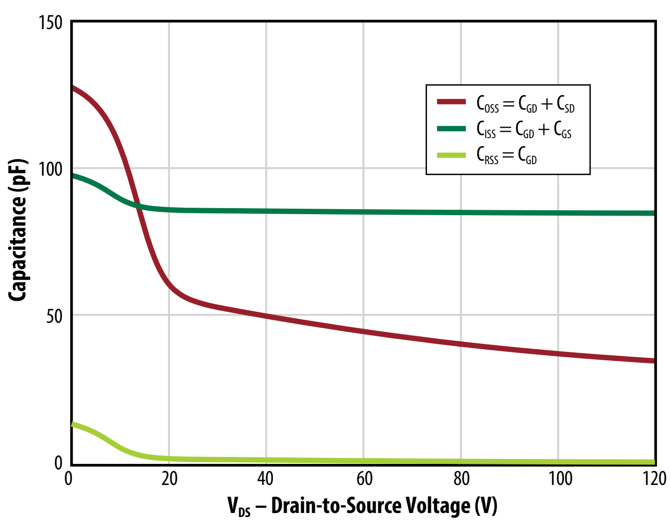


Figure 5b (Q1 & Q2): Capacitance (Log Scale)

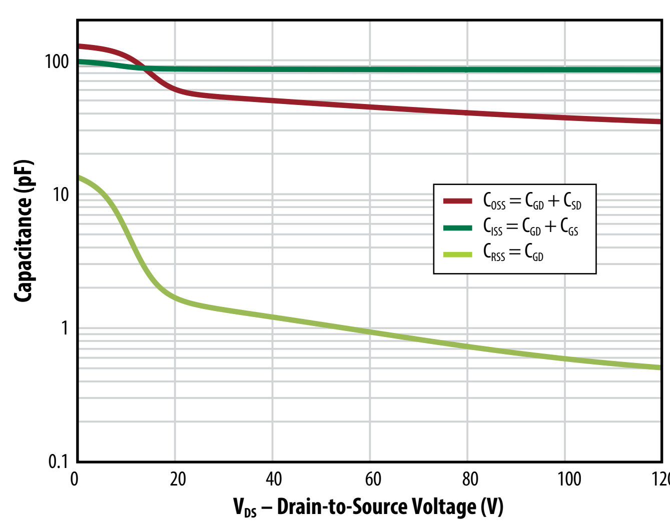


Figure 6 (Q1 & Q2): Output Charge and C_{OSS} Stored Energy

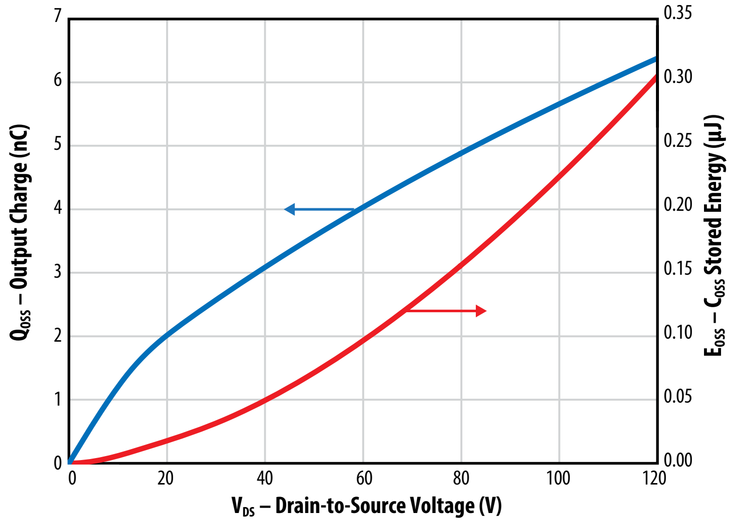


Figure 7 (Q1 & Q2): Gate Charge

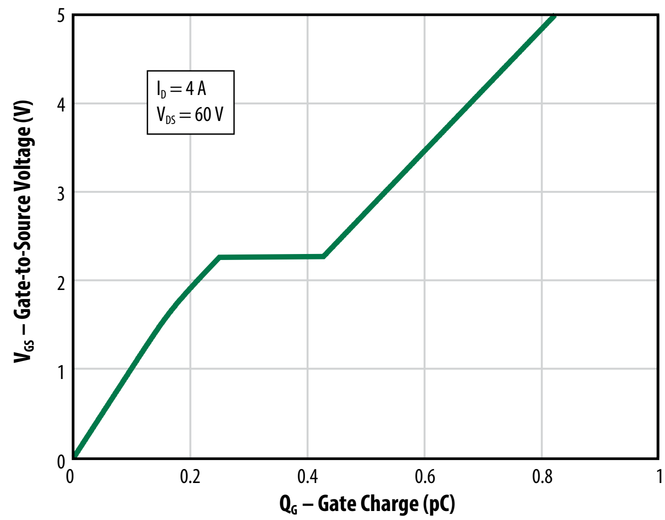


Figure 8: Reverse Drain-Source Characteristics

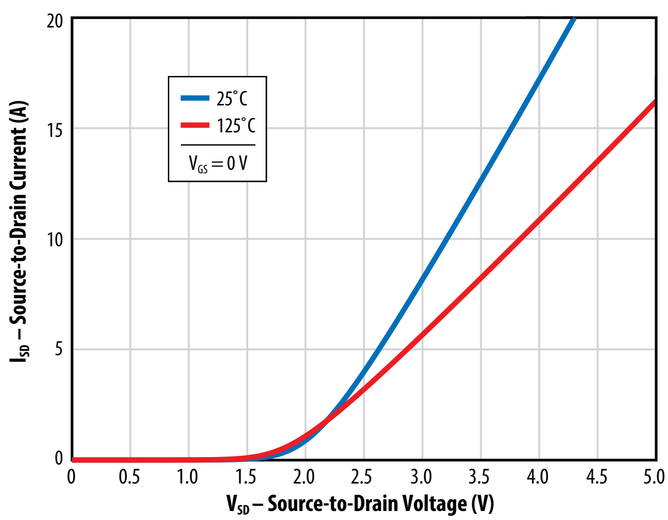


Figure 9 (Q1 & Q2):
Normalized On-State Resistance vs. Temperature

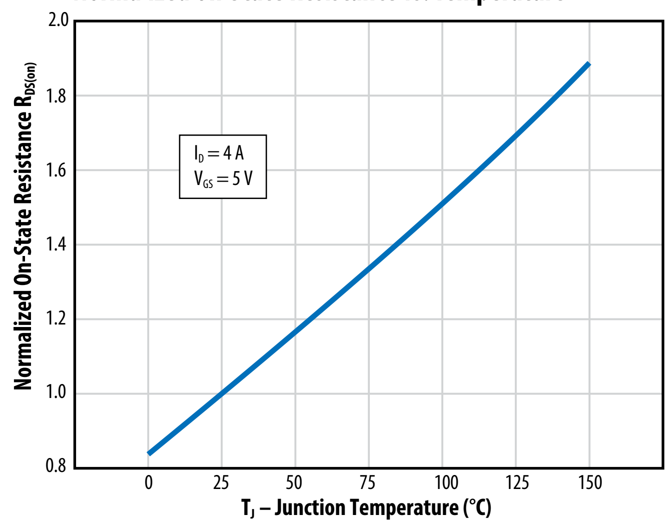


Figure 10 (Q1 & Q2):
Normalized Threshold Voltage vs. Temperature

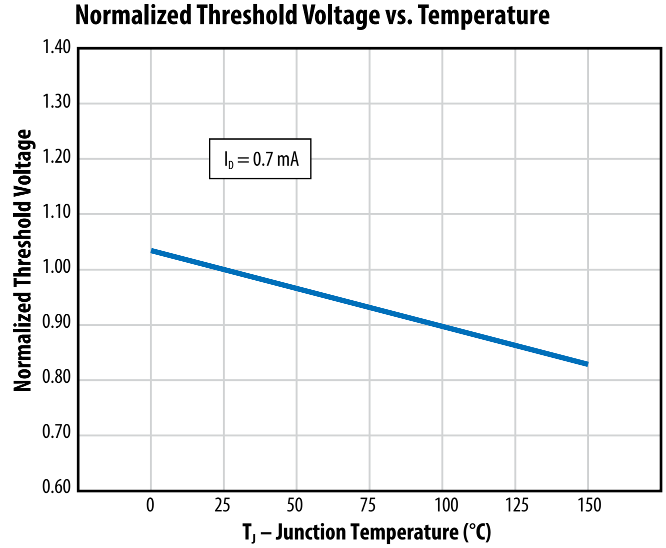


Figure 11a (Q1 & Q2): Transient Thermal Response Curves (Junction-to-Board)

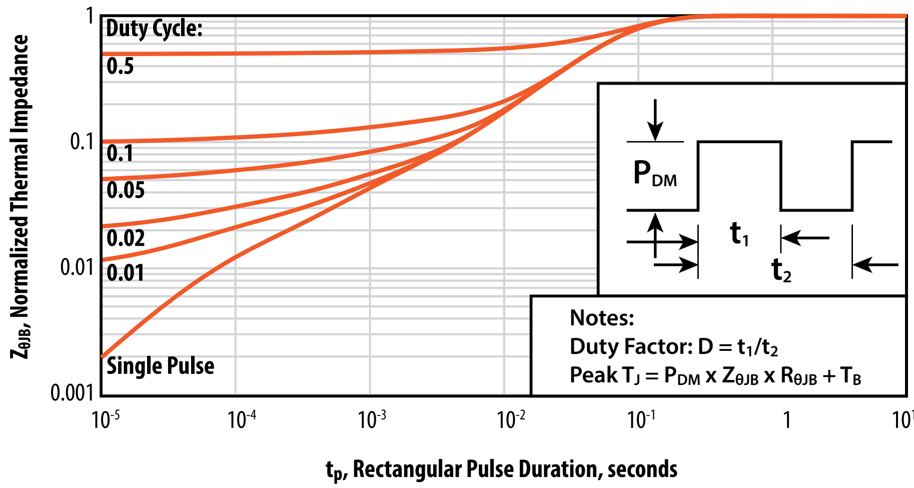


Figure 11b (Q1 & Q2): Transient Thermal Response Curves (Junction-to-Case)

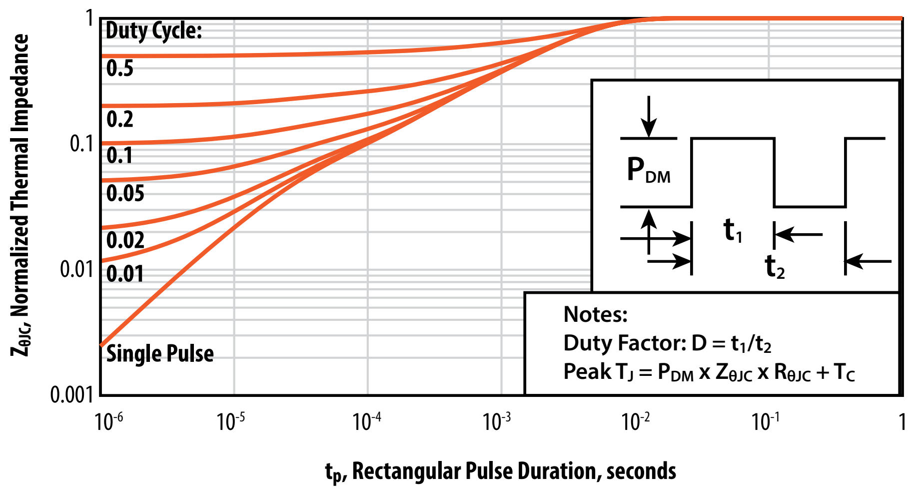
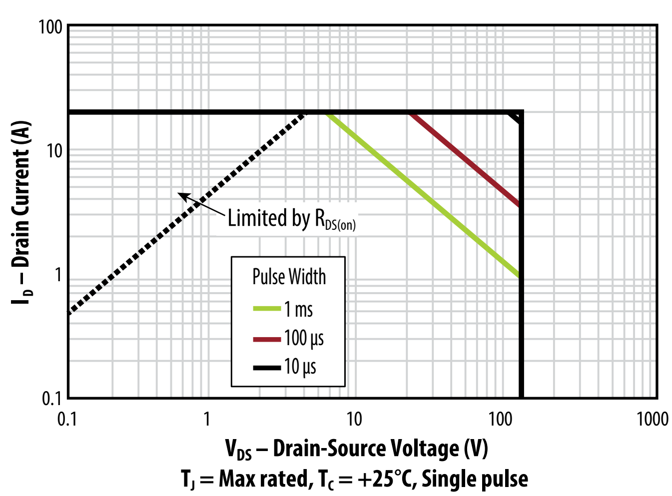
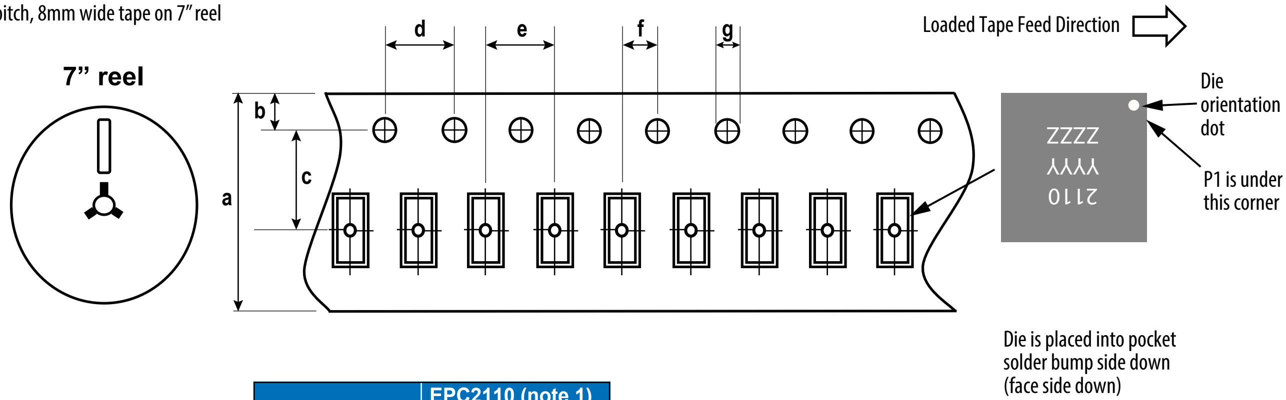


Figure 12 (Q1 & Q2): Safe Operating Area



TAPE AND REEL CONFIGURATION

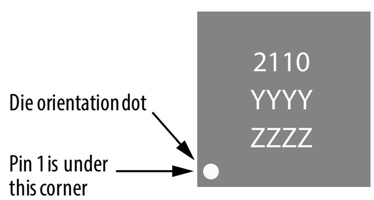
4mm pitch, 8mm wide tape on 7" reel



	EPC2110 (note 1)		
Dimension (mm)	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.

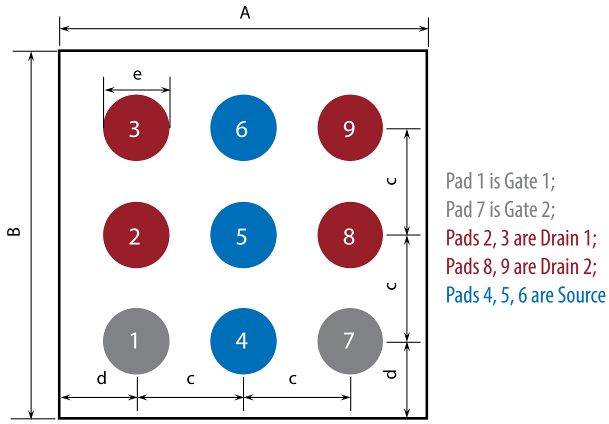
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2110	2110	YYYY	ZZZZ

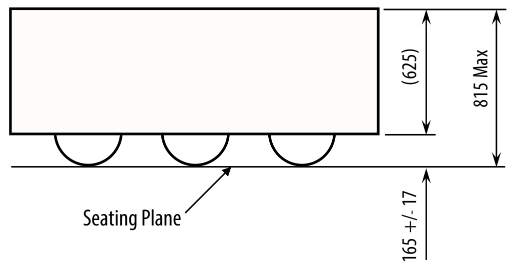
DIE OUTLINE

Solder Bump View



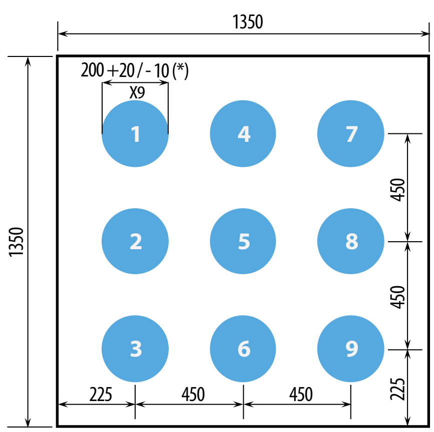
DIM	Micrometers		
	MIN	Nominal	MAX
A	1320	1350	1380
B	1320	1350	1380
c	450	450	450
d	210	225	240
e	187	208	229

Side View



RECOMMENDED LAND PATTERN

(measurements in µm)



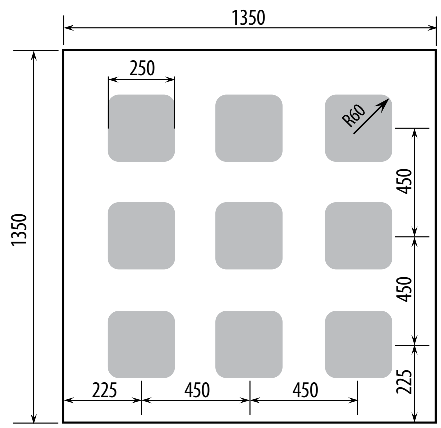
* minimum 190

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