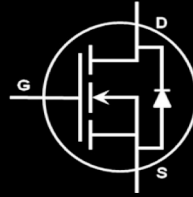


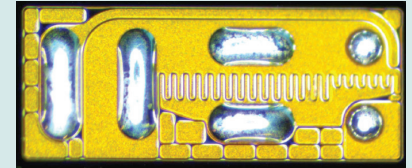
EPC8009 – Enhancement Mode Power Transistor

 $V_{DS}, 65\text{ V}$
 $R_{DS(ON)}, 130\text{ m}\Omega$
 $I_D, 2.7\text{ A}$

New Product



Gallium Nitride is grown on Silicon Wafers and processed using standard CMOS equipment leveraging the infrastructure that has been developed over the last 55 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.



EPC8009 eGaN FETs are supplied only in passivated die form with solder bars

Applications

- Ultra High Speed DC-DC Conversion
- RF Envelope Tracking
- Wireless Power Transfer
- Game Console and Industrial Movement Sensing (LiDAR)

Benefits

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

Maximum Ratings			
V_{DS}	Drain-to-Source Voltage (Continuous)	65	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 125°C)	78	
I_D	Continuous ($T_A = 25^\circ\text{C}$, $\theta_{JA} = 73$)	2.7	A
	Pulsed (25°C , $T_{Pulse} = 300\text{ }\mu\text{s}$)	7.5	
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	

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise stated)					
BV_{DSS}	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}$, $I_D = 125\text{ }\mu\text{A}$	65		V
I_{DSS}	Drain Source Leakage	$V_{GS} = 0\text{ V}$, $V_{DS} = 52\text{ V}$, $T = 25^\circ\text{C}$	50	100	μA
I_{GSS}	Gate-Source Forward Leakage	$V_{GS} = 5\text{ V}$	100	500	μA
	Gate-Source Reverse Leakage	$V_{GS} = -4\text{ V}$	50	100	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{GS} = V_{GS}$, $I_D = 0.25\text{ mA}$	0.8	1.4	V
$R_{DS(ON)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}$, $I_D = 0.5\text{ A}$	90	130	$\text{m}\Omega$
V_{SD}	Source-Drain Forward Voltage	$I_S = 0.5\text{ A}$, $V_{GS} = 0\text{ V}$	2.2		V

Specifications are with substrate shorted to source where applicable.

Thermal Characteristics			
		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction to Case	8.2	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction to Board	16	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1)	82	°C/W

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.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Dynamic Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise stated)					
C_{ISS}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 32.5\text{ V}$	45	52	pF
C_{OSS}	Output Capacitance		19	28	
C_{RSS}	Reverse Transfer Capacitance		0.5	0.8	
R_G	Gate Resistance		0.3		Ω
Q_G	Total Gate Charge	$V_{DS} = 32.5\text{ V}, I_D = 1\text{ A}$	370	450	pC
Q_{GS}	Gate to Source Charge		120		
Q_{GD}	Gate to Drain Charge		55	94	
$Q_{G(TH)}$	Gate Charge at Threshold		96		
Q_{OSS}	Output Charge	$V_{GS} = 0\text{ V}, V_{DS} = 32.5\text{ V}$	940	1400	
Q_{RR}	Source-Drain Recovery Charge		0		

Specifications are with substrate shorted to source where applicable.

Figure 1: Typical Output Characteristics at 25°C

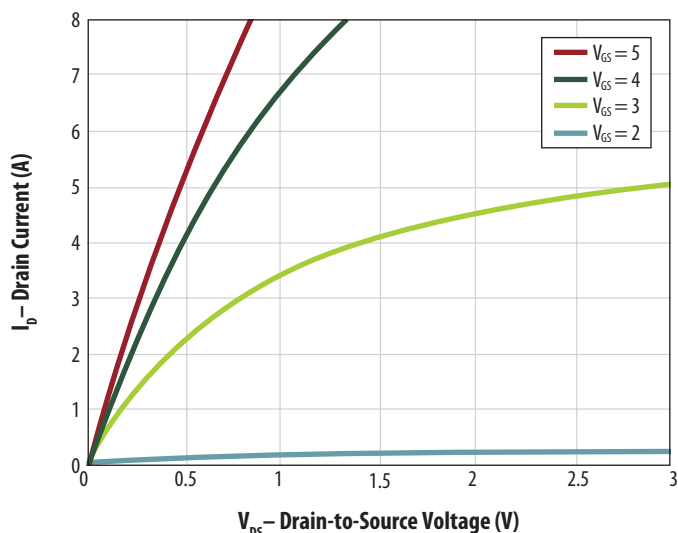


Figure 2: Transfer Characteristics

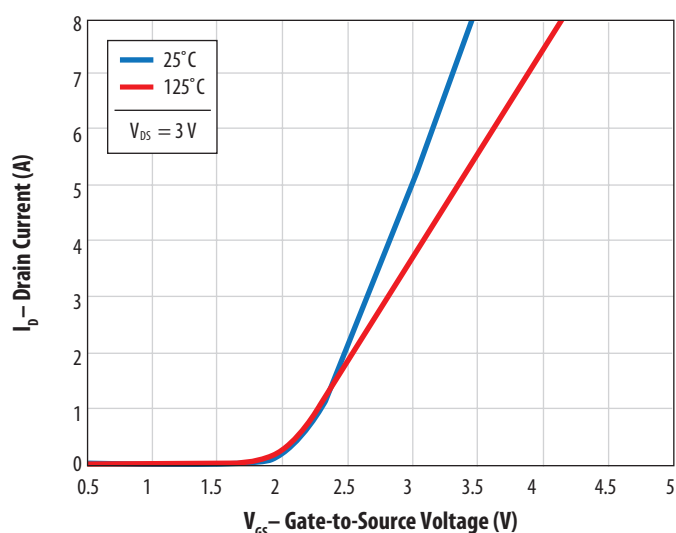


Figure 3: $R_{DS(ON)}$ vs V_{GS} for Various Drain Currents

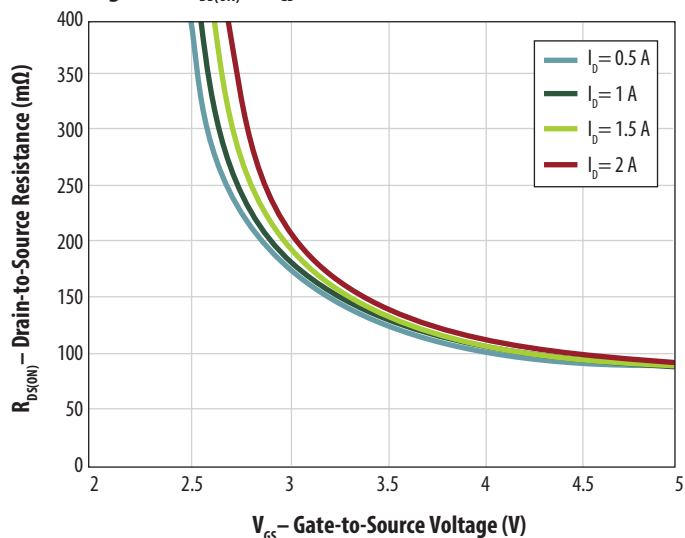


Figure 4: $R_{DS(ON)}$ vs V_{GS} for Various Temperatures

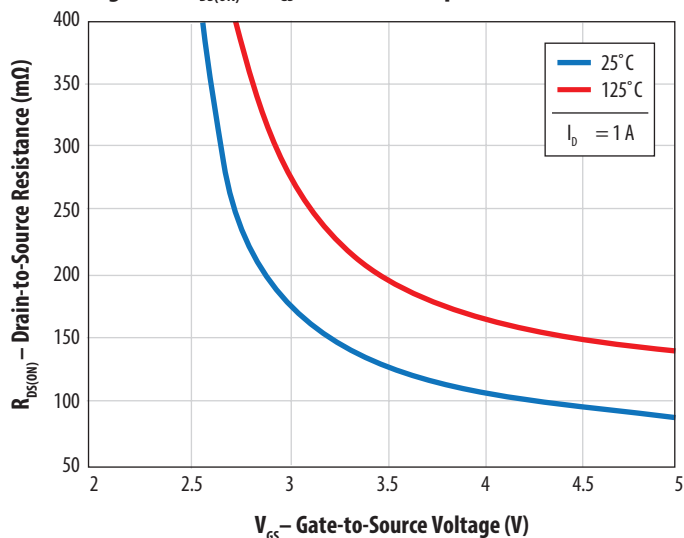


Figure 5: Capacitance (Linear Scale)

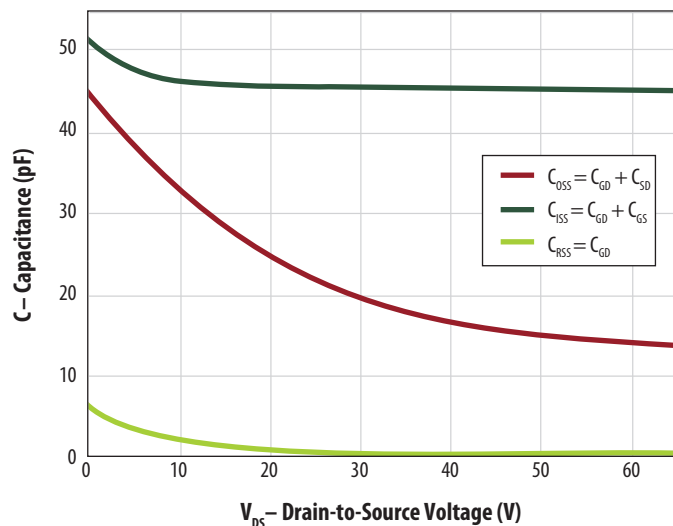


Figure 5A: Capacitance (Log Scale)

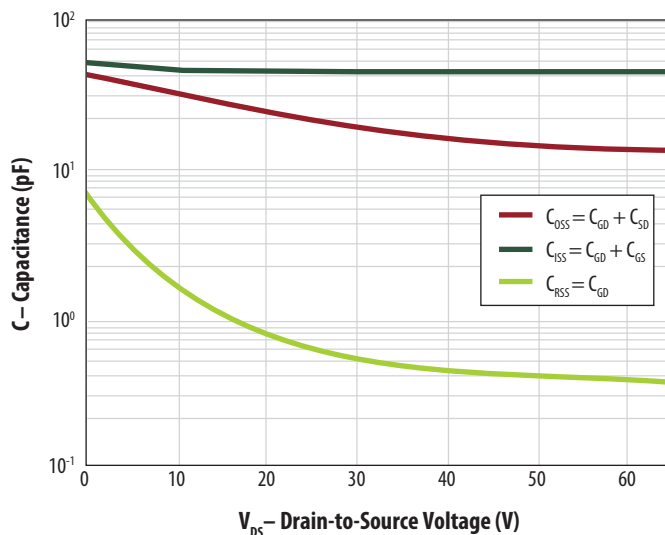


Figure 6: Gate Charge

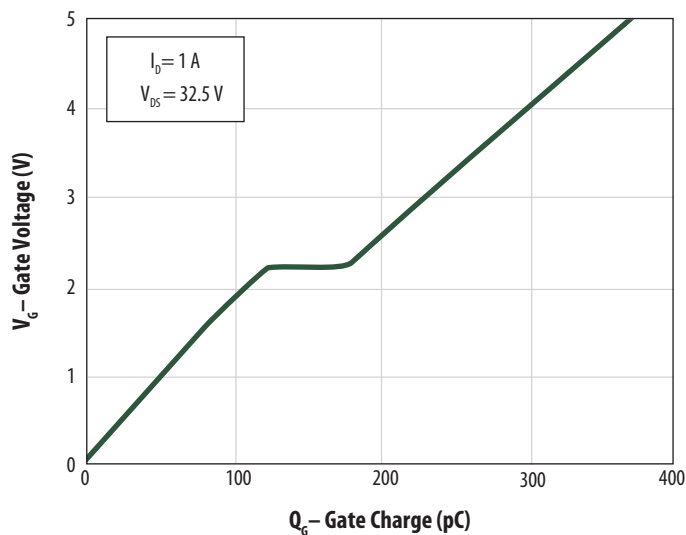


Figure 7: Reverse Drain-Source Characteristics

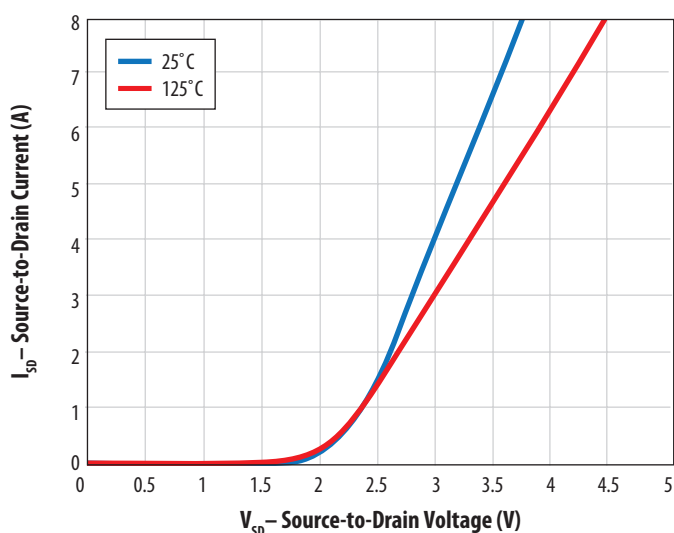
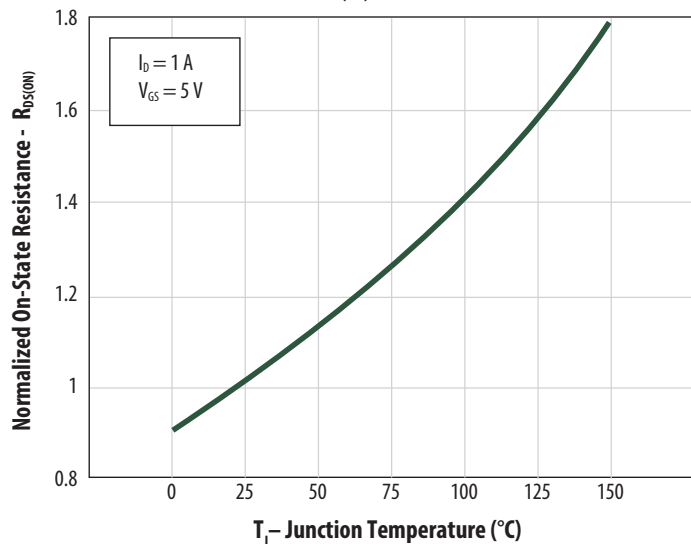
Figure 8: Normalized $R_{DS(ON)}$ 

Figure 9: Normalized Threshold Voltage vs Temperature

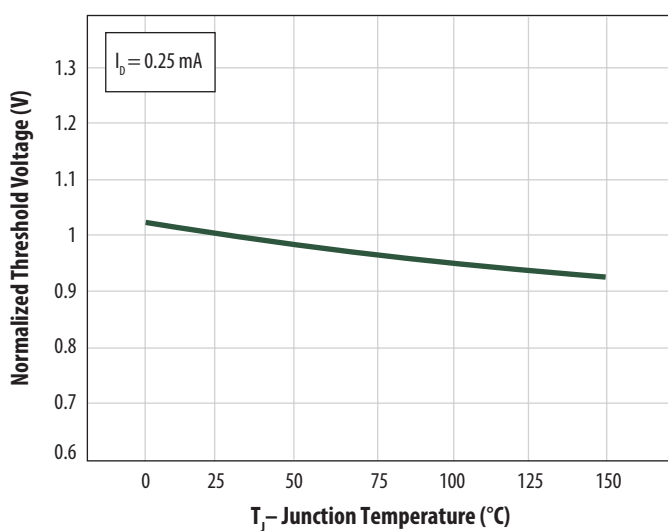
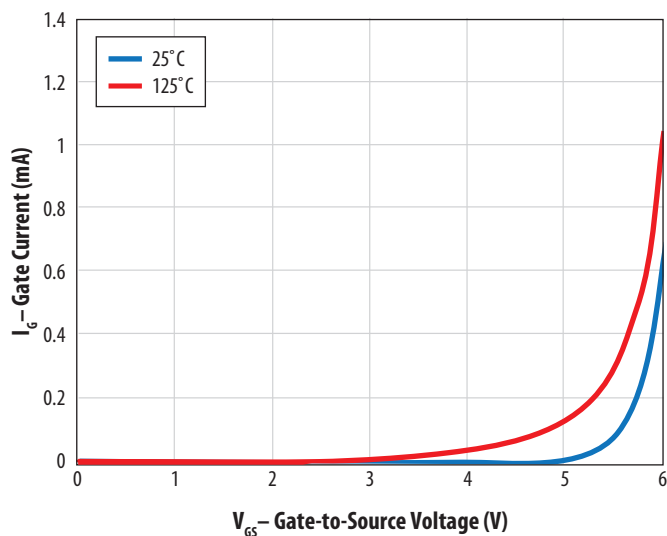
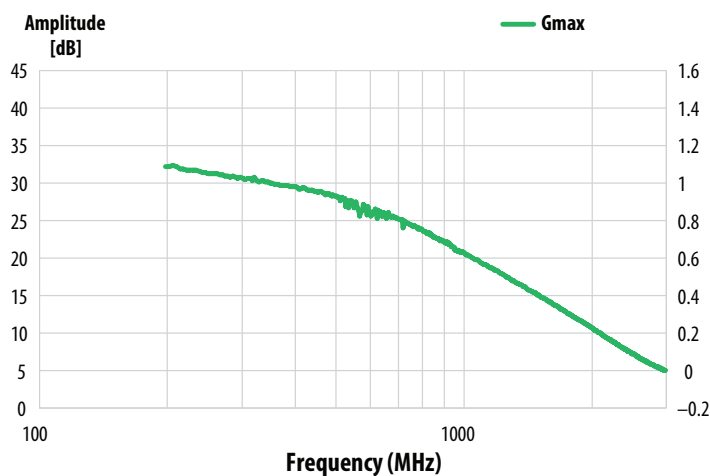


Figure 10: Gate Current



All measurements were done with substrate shortened to source.

Figure 12: Gain Chart



Frequency [MHz]	Gate (Z_{GS}) [Ω]	Drain (Z_{DS}) [Ω]
200	$1.98 - j8.58$	$16.83 - j11.29$
500	$1.87 - j2.15$	$10.69 - j9.69$
1000	$1.39 + j2.14$	$5.22 - j5.45$
1200	$1.21 + j3.56$	$3.53 - j3.42$
1500	$1.01 + j4.96$	$2.35 - j0.81$
2000	$0.83 + j7.83$	$1.57 + j3.52$
2400	$0.73 + j10.14$	$1.54 + j6.19$
3000	$0.58 + j14.27$	$1.84 + j10.20$

S-Parameter Table - Download S-parameter files at www.epc-co.com

Figure 11: Smith Chart

S-Parameter Characteristics
 $V_{GSQ} = 2.36 \text{ V}$, $V_{DSQ} = 30 \text{ V}$, $I_{DQ} = 0.50 \text{ A}$
 Pulsed Measurement, Heat-Sink Installed, $Z_0 = 50 \Omega$

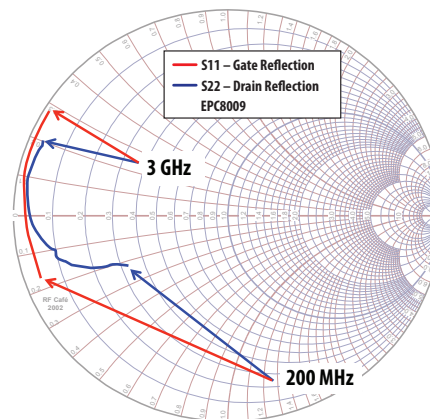


Figure 13: Device Reflection

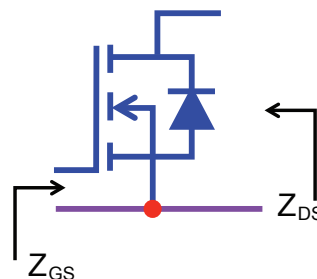


Figure 14: Taper and Reference Plane details – Device Connection

Micro-Strip design: 2-layer
 ½ oz (17.5 μm) thick copper
 30 mil thick R04350 substrate

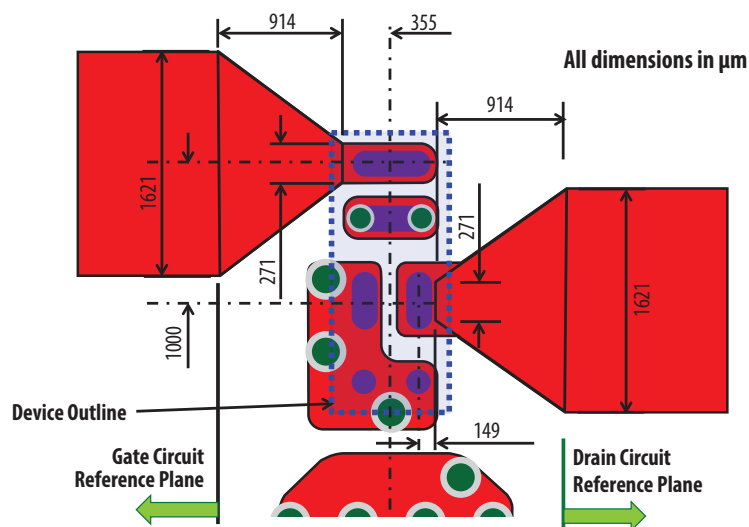


Figure 15: Transient Thermal Response Curves

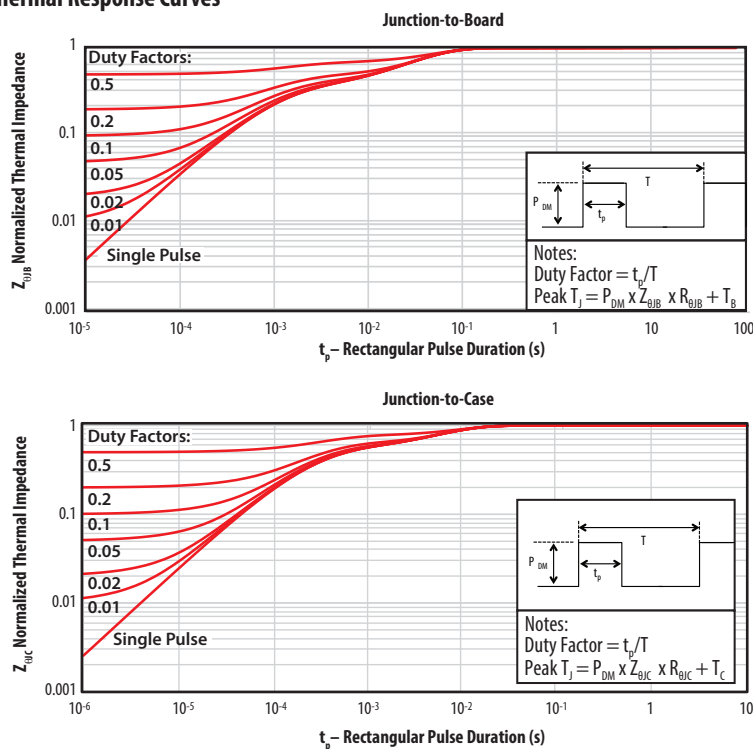
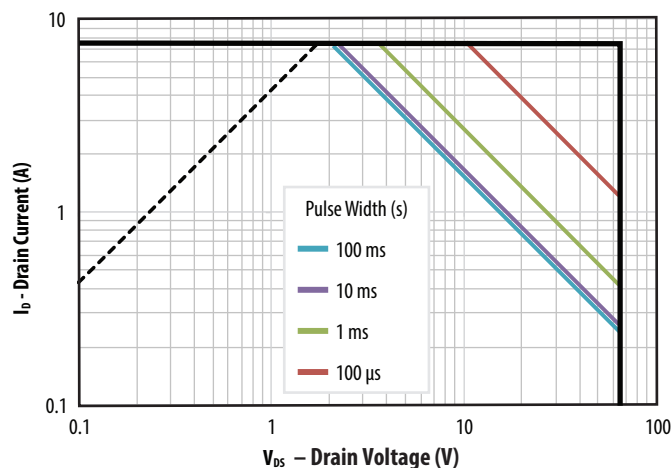
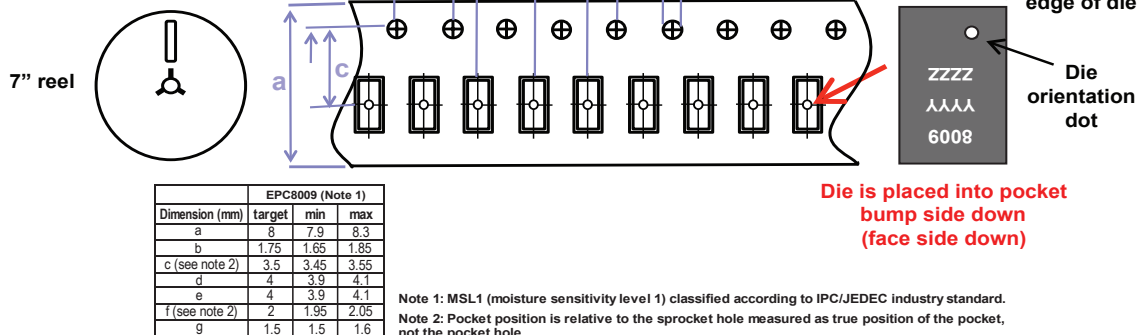


Figure 16: Safe Operating Area

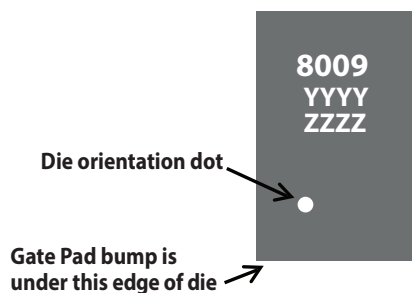


TAPE AND REEL CONFIGURATION

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



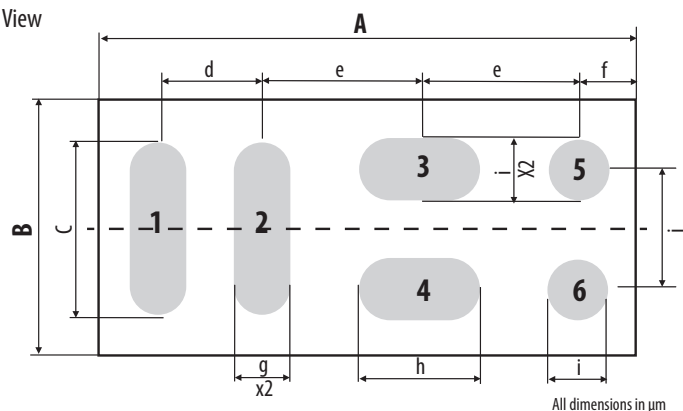
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking line 2	Lot_Date Code Marking Line 3
EPC8009	8009	YYYY	ZZZZ

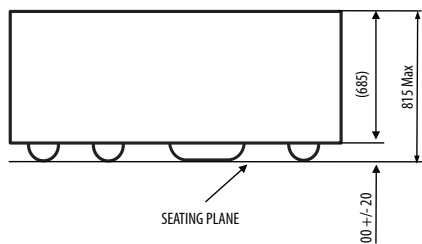
DIE OUTLINE

Solder Bar View

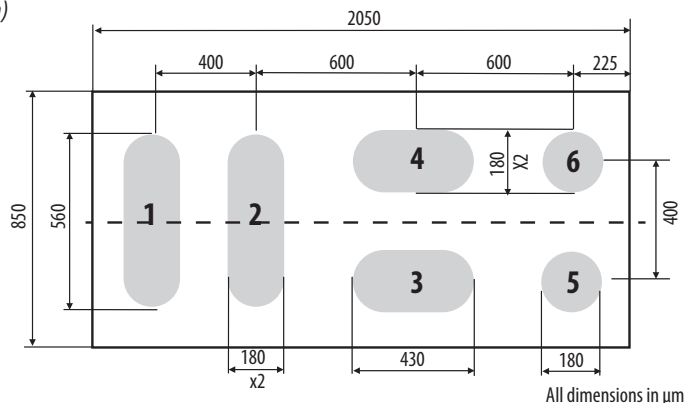


Dim	Micrometers		
	Min	Nominal	Max
A	2020	2050	2080
B	820	850	880
C	555	580	605
D	400	400	400
E	600	600	600
F	200	225	250
G	175	200	225
H	425	450	475
I	175	200	225
J	400	400	400

Side View



Pad no. 1 is Gate
 Pad no. 2 is Source Return for Gate Driver
 Pad no. 3 and 5 are Source
 Pad no. 4 is Drain
 Pad no. 6 is Substrate

RECOMMENDED
LAND PATTERN(units in μm)

Pad no. 1 is Gate
 Pad no. 2 is Source Return for Gate Driver
 Pad no. 3 and 5 are Source
 Pad no. 4 is Drain
 Pad no. 6 is Substrate

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

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

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U.S. Patents 8,350,294; 8,404,508; 8,431,960; 8,436,398; 8,785,974; 8,890,168; 8,969,918; 8,853,749; 8,823,012

Information subject to
 change without notice.

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