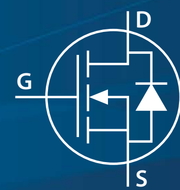
EPC8002 – Enhancement Mode Power Transistor

V_{DS} , 65 V
$R_{DS(on)}$, 480 mΩ
I_D , 2 A



EFFICIENT POWER CONVERSION

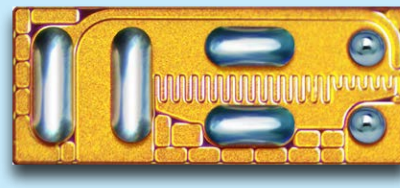
RoHS Halogen-Free

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			
PARAMETER		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	65	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	78	
I_D	Continuous (T_A = 25°C, $R_{\theta JA}$ = 36°C/W)	2	A
	Pulsed (25°C, T_{PULSE} = 300 µs)	2	
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			
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	8.2	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	16	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	82	

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 for details



EPC8002 eGaN FETs are supplied only in passivated die form with solder bars
Die Size: 2.1 x 0.85 mm

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

Static Characteristics (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 = 125 µA	65			V
I_{DSS}	Drain-Source Leakage	V_{DS} = 52 V, V_{GS} = 0 V		20	100	µA
I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.1	1	mA
	Gate-to-Source Reverse Leakage	V_{GS} = -4 V		20	100	µA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.1 mA	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 0.5 A		380	480	mΩ
V_{SD}	Source-Drain Forward Voltage	I_S = 0.4 A, V_{GS} = 0 V		2.6		V

Specifications are with substrate connected to source where applicable.

Dynamic Characteristics (T_J = 25˚C unless otherwise stated)						
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	V_{DS} = 32.5 V, V_{GS} = 0 V		20	24	pF
C_{RSS}	Reverse Transfer Capacitance			0.12	0.18	
C_{OSS}	Output Capacitance			6.7	10	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{DS} = 0 to 32.5 V, V_{GS} = 0 V		8.9		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			10		
R_G	Gate Resistance			0.3		Ω
Q_G	Total Gate Charge	V_{DS} = 32.5 V, V_{GS} = 5 V, I_D = 0.5 A		133	167	pC
Q_{GS}	Gate-to-Source Charge	V_{DS} = 32.5 V, I_D = 0.5 A		57		
Q_{GD}	Gate-to-Drain Charge			15	26	
$Q_{G(TH)}$	Gate Charge at Threshold			46		
Q_{OSS}	Output Charge	V_{DS} = 32.5 V, V_{GS} = 0 V		334	500	
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% BVDSS.
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% BVDSS.

Figure 1: Typical Output Characteristics at 25°C

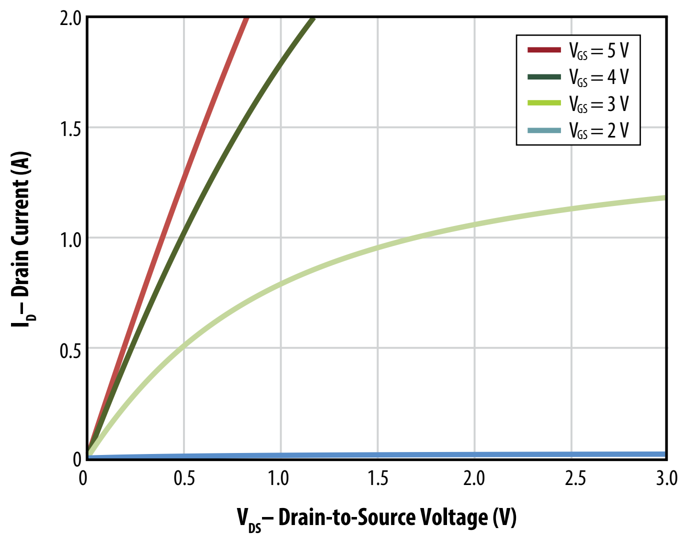


Figure 2: Transfer Characteristics

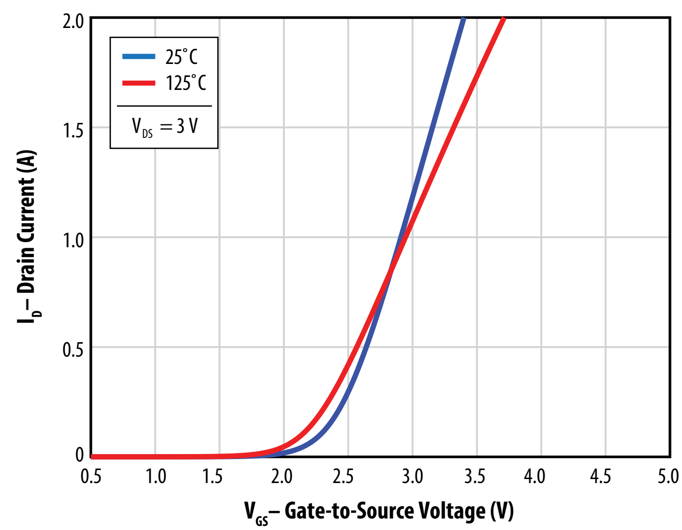


Figure 3: $R_{DS(on)}$ vs V_{GS} for Various Drain Currents

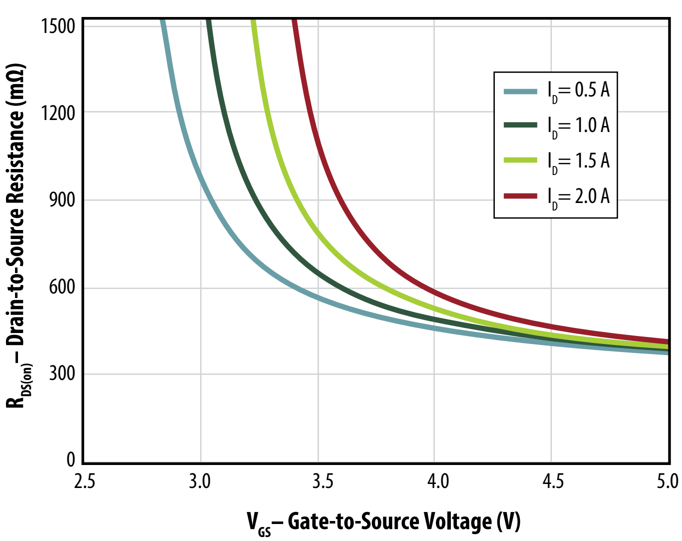


Figure 4: $R_{DS(on)}$ vs V_{GS} for Various Temperatures

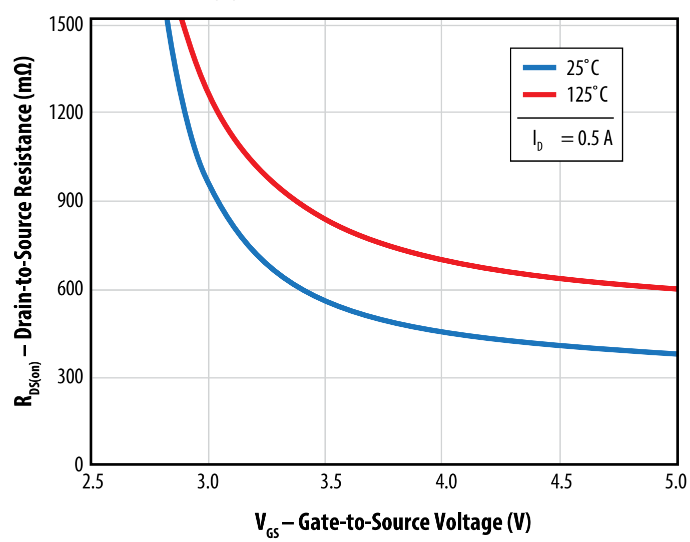


Figure 5: Capacitance (Linear Scale)

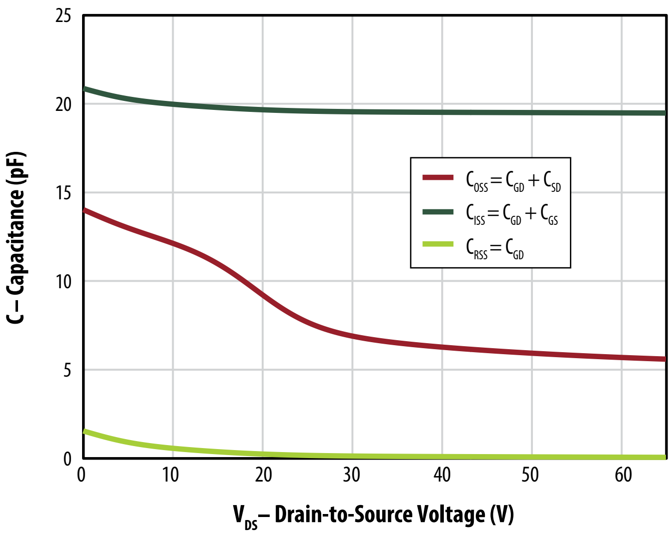


Figure 5A: Capacitance (Log Scale)

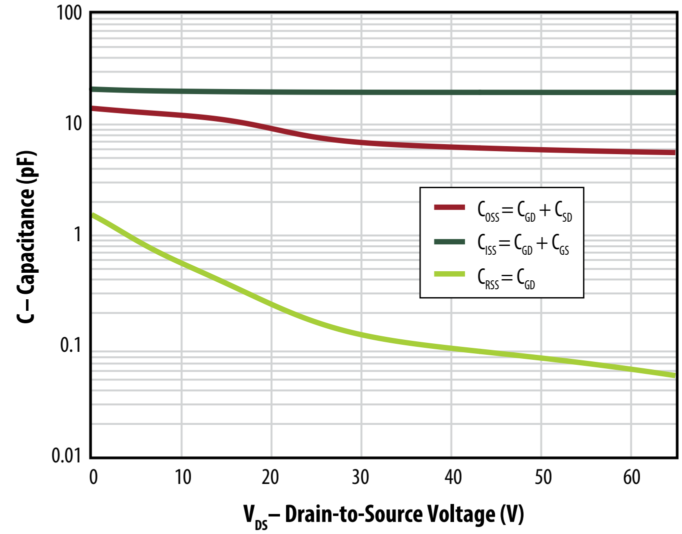


Figure 6: Gate Charge

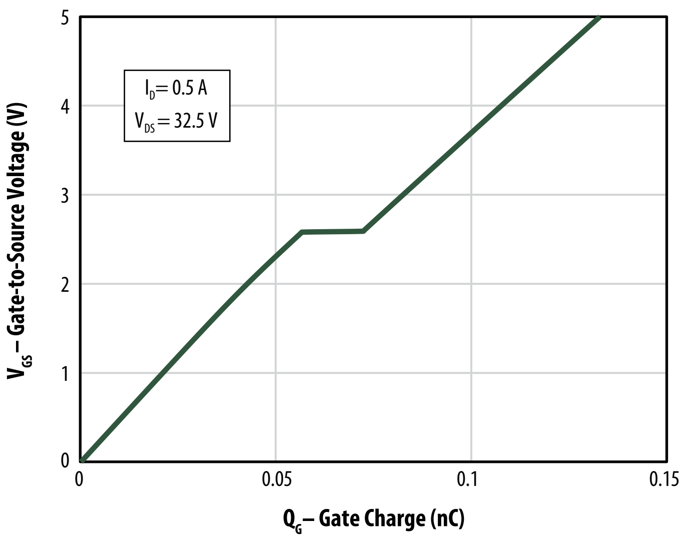


Figure 7: Reverse Drain-Source Characteristics

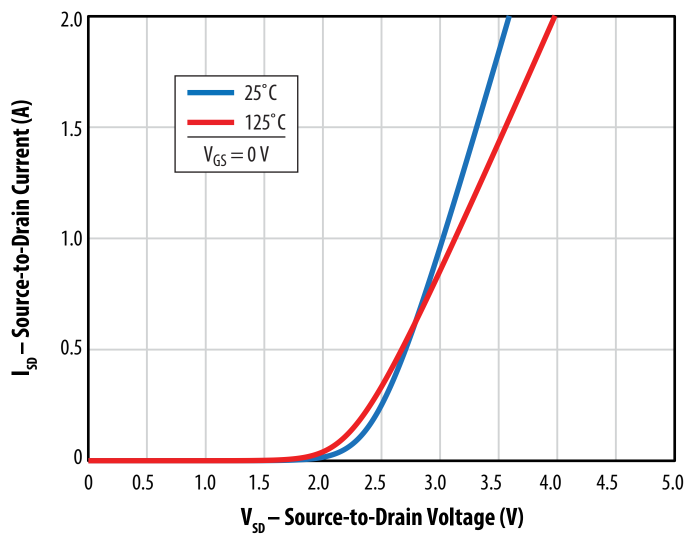


Figure 8: Normalized On-State Resistance vs Temperature

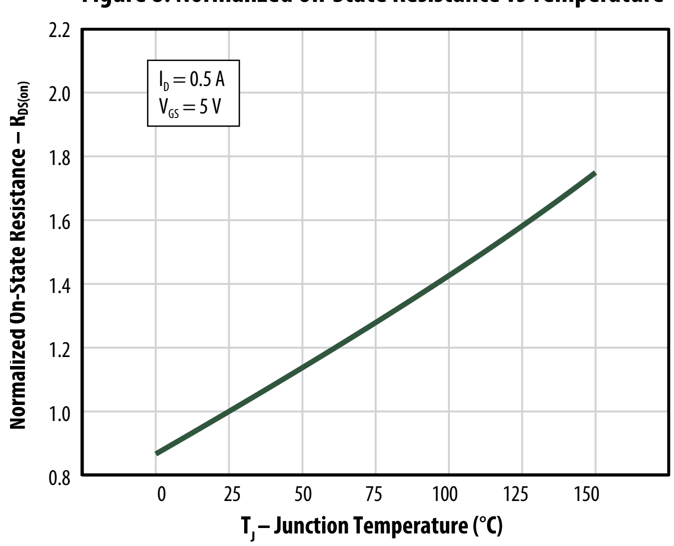


Figure 9: Normalized Threshold Voltage vs Temperature

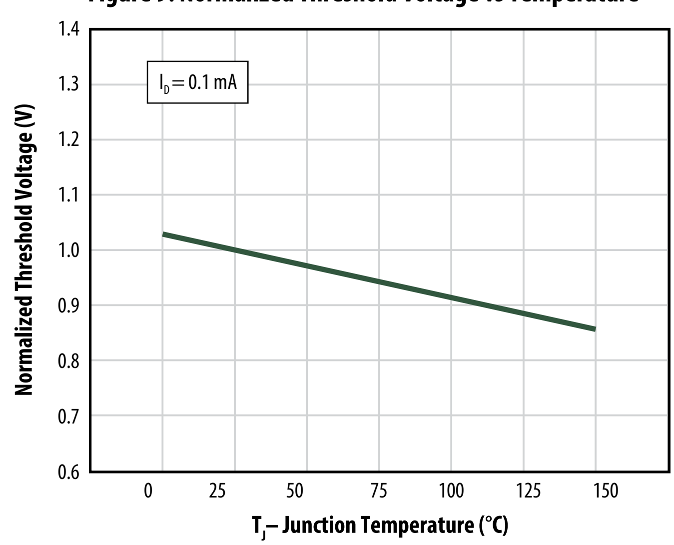
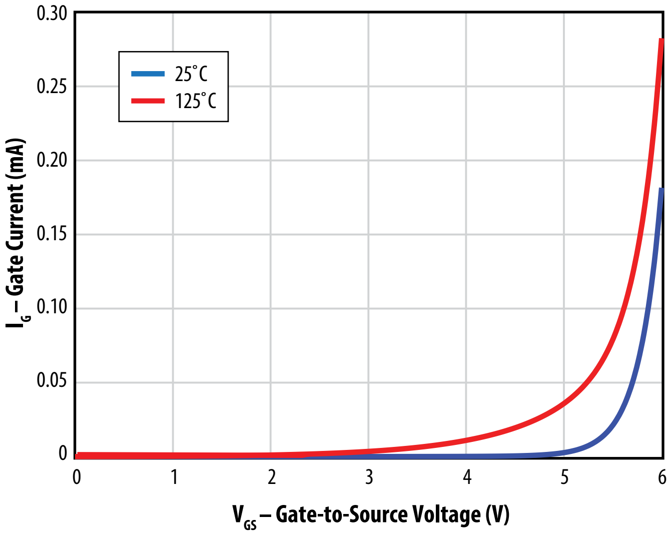


Figure 10: Gate Leakage Current



All measurements were done with substrate shortened to source.

Figure 11: Smith Chart

S-Parameter Characteristics
V_{GSQ} = 1.17 V, V_{DSQ} = 30 V, I_{DQ} = 0.2 A
Pulsed Measurement, Heat-Sink Installed, Z_0 = 50 Ω

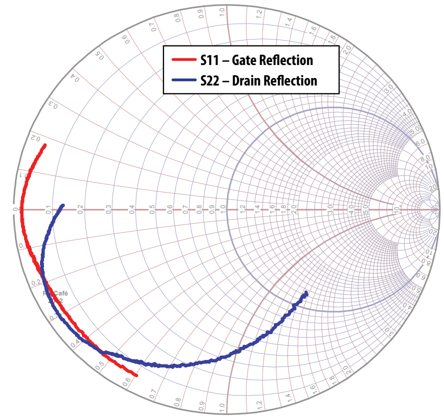


Figure 12: Gain Chart

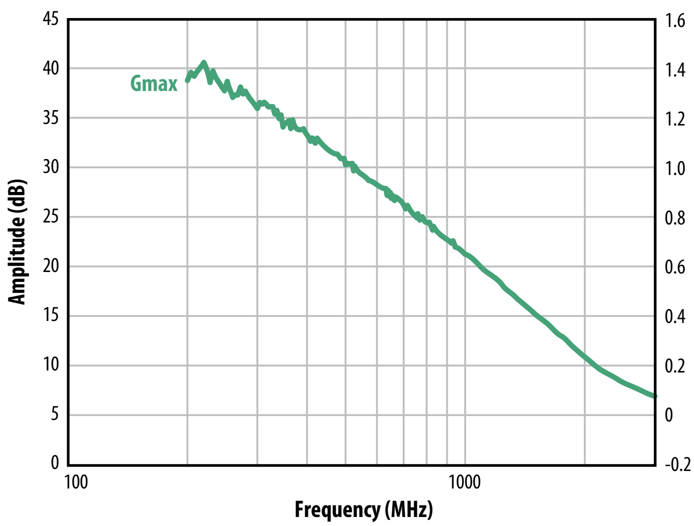
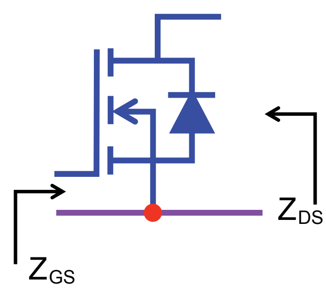


Figure 13: Device Reflection



Frequency	Gate (Z_{GS})	Drain (Z_{DS})
[MHz]	[Ω]	[Ω]
200	3.09 - j29.97	63.13 - j71.32
500	2.20 - j11.92	15.96 -j46.65
1000	1.14 - j4.46	3.35 - j23.47
1200	0.95 - j2.76	1.91 - j18.52
1500	0.87 - j0.55	1.66 - j12.66
2000	1.09 + j2.61	2.28 - j6.12
2400	1.44 + j4.87	4.35 - j2.80
3000	2.36 + j8.79	6.41 + j0.69

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

Figure 14: Taper and Reference Plane details – Device Connection

Micro-Strip design: 2-layer
½ oz (17.5 µm) thick copper
30 mil thick RO4350 substrate

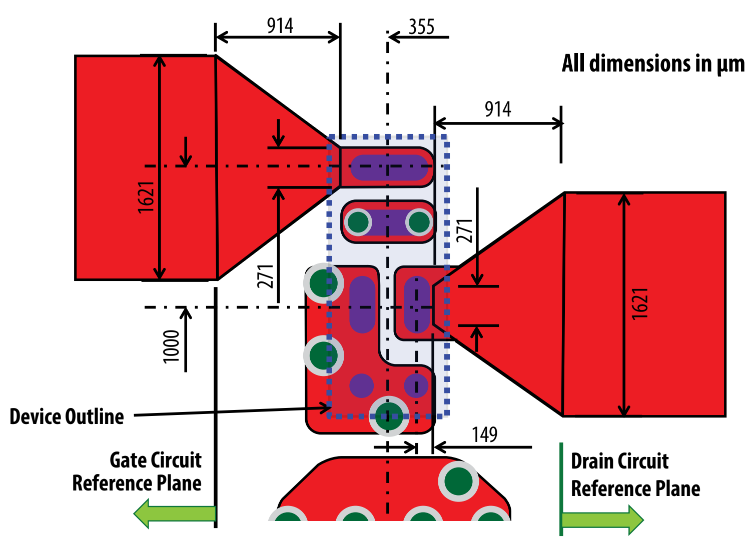
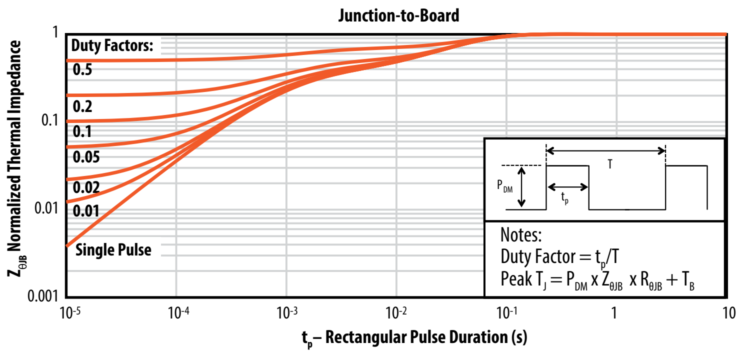


Figure 15: Transient Thermal Response Curves



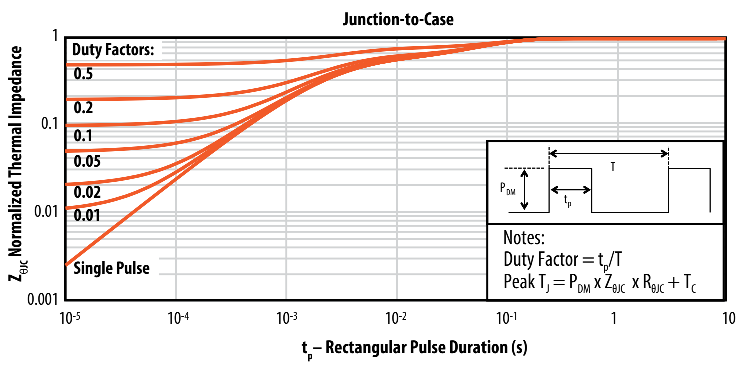
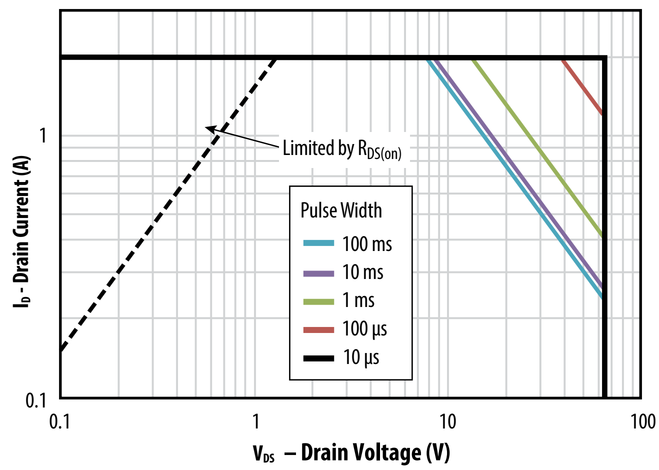
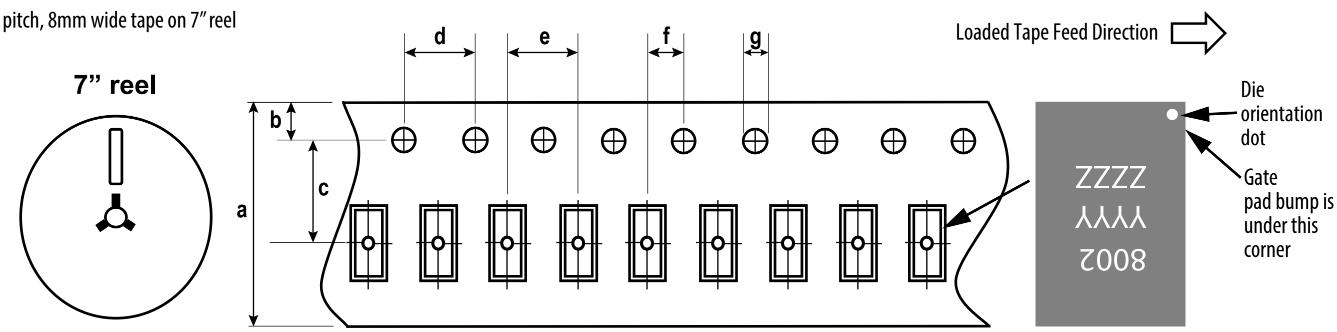


Figure 16: Safe Operating Area



TAPE AND REEL CONFIGURATION

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

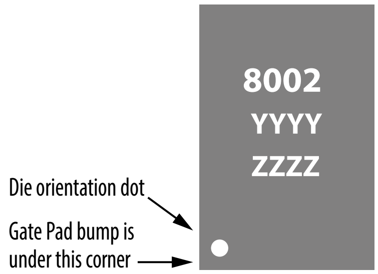


Die is placed into pocket solder bump side down (face side down)

	EPC8002 (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.

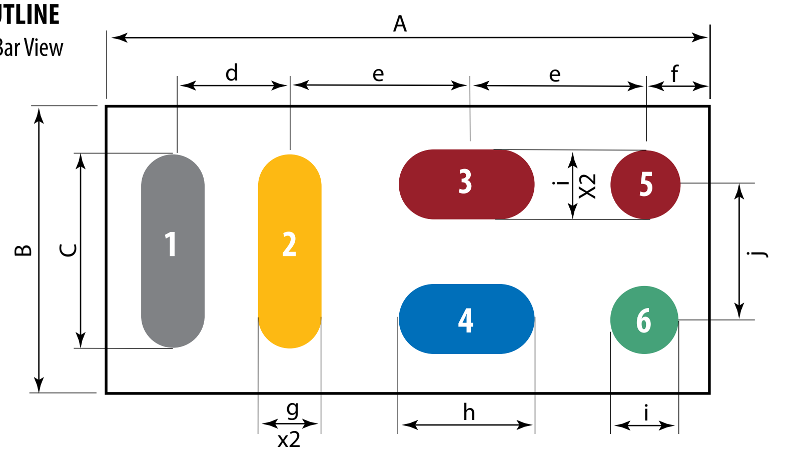
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking line 2	Lot_Date Code Marking Line 3
EPC8002	8002	YYYY	ZZZZ

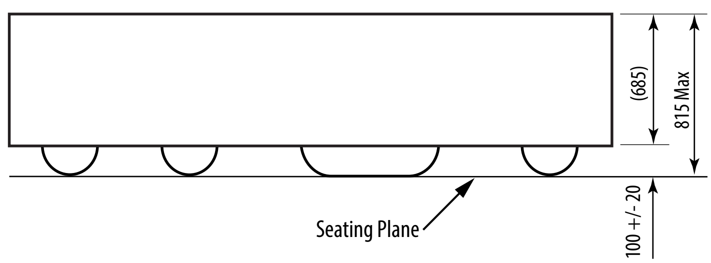
DIE OUTLINE

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

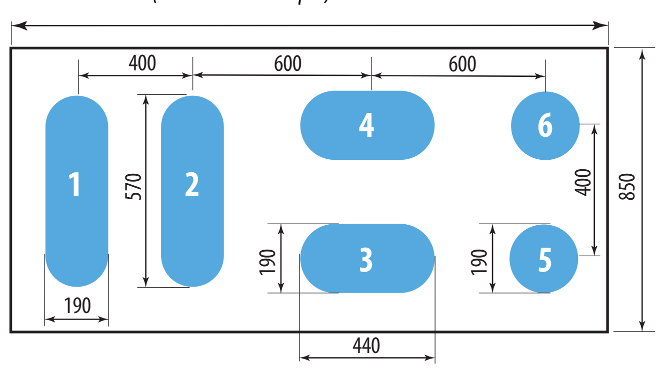
Side View



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*

*Substrate pin should be connected to Source

RECOMMENDED LAND PATTERN *(measurements in µm)*

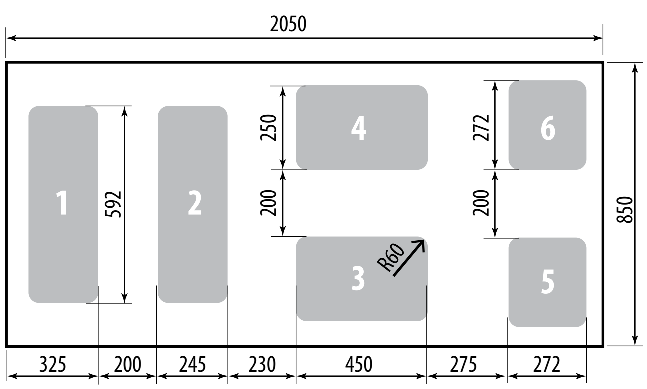


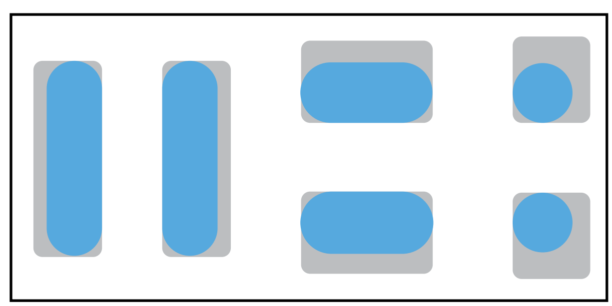
The land pattern is solder mask defined.
Solder mask opening is 5 µm smaller per side than bump.

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*

*Substrate pin should be connected to Source

RECOMMENDED STENCIL DRAWING *(measurements in µm)*





Blue = bump, Gray = stencil

Recommended stencil should be 4 mil (100 µm) thick, must be laser cut, openings per drawing. Intended for use with SAC305 Type 3 solder, reference 88.5% metals content.

Additional assembly resources available at: https://epc-co.com/epc/design-support/assemblybasics