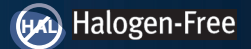
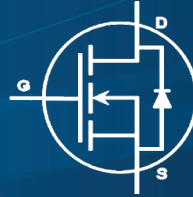
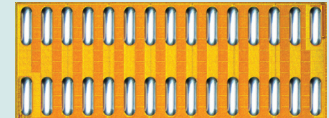


## EPC2021 – Enhancement Mode Power Transistor

 $V_{DSS}$ , 80 V $R_{DS(on)}$ , 2.5 m $\Omega$  $I_D$ , 90 A

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.



EPC2021 eGaN® FETs are supplied only in passivated die form with solder bumps.  
Die Size: 6.05 mm x 2.3 mm

- High Speed DC-DC Conversion
- Motor Drive
- Industrial Automation
- Synchronous Rectification
- Inrush Protection
- Class-D Audio

[www.epc-co.com/epc/Products/eGaNfETs/EPC2021.aspx](http://www.epc-co.com/epc/Products/eGaNfETs/EPC2021.aspx)

## Maximum Ratings

Maximum Ratings			
$V_{DS}$	Drain-to-Source Voltage (Continuous)	80	V
	Drain-to-Source Voltage (up to 10,000 5ms pulses at 150°C)	96	
$I_D$	Continuous ( $T_A = 25^\circ\text{C}$ , $R_{\theta JA} = 3.5^\circ\text{C/W}$ )	90	A
	Pulsed ( $25^\circ\text{C}$ , $T_{PULSE} = 300 \mu\text{s}$ )	420	
$V_{GS}$	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)

Static Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise stated)						
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
$BV_{DSS}$	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	80			V
$I_{DSS}$	Drain Source Leakage	$V_{DS} = 64\text{ V}$ , $V_{GS} = 0\text{ V}$		0.1	0.7	mA
$I_{GSS}$	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}$		1	9	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		0.1	0.7	mA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 14\text{ mA}$	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 5\text{ V}$ , $I_D = 29\text{ A}$		1.8	2.5	m $\Omega$
$V_{SD}$	Source-to-Drain Forward Voltage	$I_S = 0.5\text{ A}$ , $V_{GS} = 0\text{ V}$		1.6		V

All measurements were done with substrate shorted to source.

## Thermal Characteristics

		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.4	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction to Board	1.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1)	42	°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](http://epc-co.com/epc/documents/product-training/Appnote_Thermal_Performance_of_eGaN_FETs.pdf) for details.

Dynamic Characteristics (T <sub>J</sub> = 25°C unless otherwise stated)						
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
C <sub>ISS</sub>	Input Capacitance		1650	1980	pF	
C <sub>RSS</sub>	Reverse Transfer Capacitance		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V	20		
C <sub>OSS</sub>	Output Capacitance			970		1460
C <sub>OSS(ER)</sub>	Effective Output Capacitance, Energy Related (Note 2)	V <sub>DS</sub> = 0 to 40 V, V <sub>GS</sub> = 0 V	1090			
C <sub>OSS(TR)</sub>	Effective Output Capacitance, Time Related (Note 3)		1310			
R <sub>G</sub>	Gate Resistance		0.3		Ω	
Q <sub>G</sub>	Total Gate Charge	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 29 A	15	19	nC	
Q <sub>GS</sub>	Gate-to-Source Charge	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 29 A	3.4			
Q <sub>GD</sub>	Gate-to-Drain Charge		2.3			
Q <sub>G(TH)</sub>	Gate Charge at Threshold		2.5			
Q <sub>OSS</sub>	Output Charge	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V	63	95		
Q <sub>RR</sub>	Source-to-Drain Recovery Charge		0			

Note 2: C<sub>OSS(ER)</sub> is a fixed capacitance that gives the same stored energy as C<sub>OSS</sub> while V<sub>DS</sub> is rising from 0 to 50% BV<sub>OSS</sub>.  
 Note 3: C<sub>OSS(TR)</sub> is a fixed capacitance that gives the same charging time as C<sub>OSS</sub> while V<sub>DS</sub> is rising from 0 to 50% BV<sub>OSS</sub>.

Figure 1: Typical Output Characteristics at 25°C

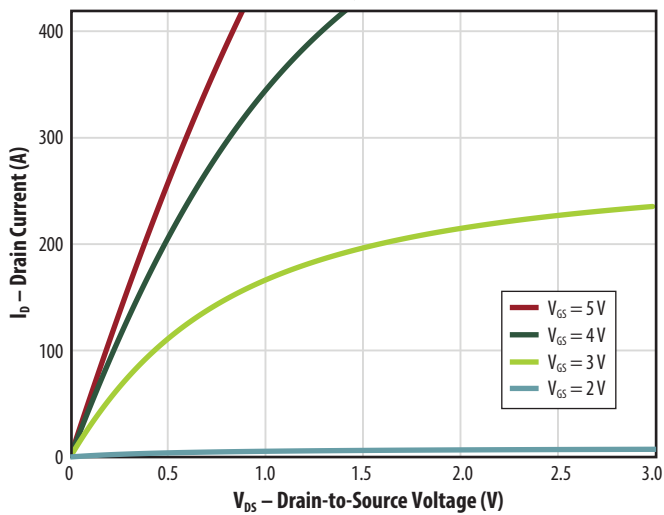


Figure 2: Transfer Characteristics

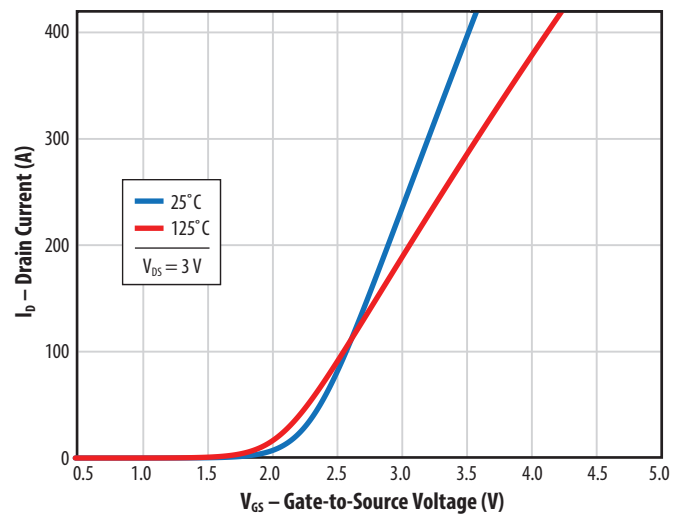


Figure 3: R<sub>DS(on)</sub> vs. V<sub>GS</sub> for Various Drain Currents

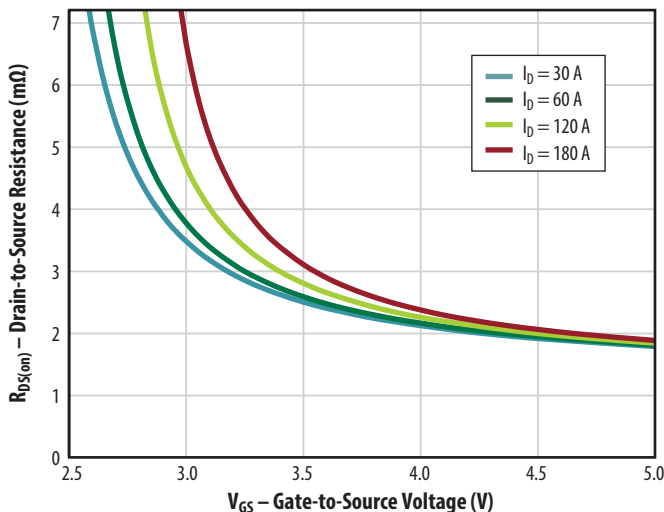


Figure 4: R<sub>DS(on)</sub> vs. V<sub>GS</sub> for Various Temperatures

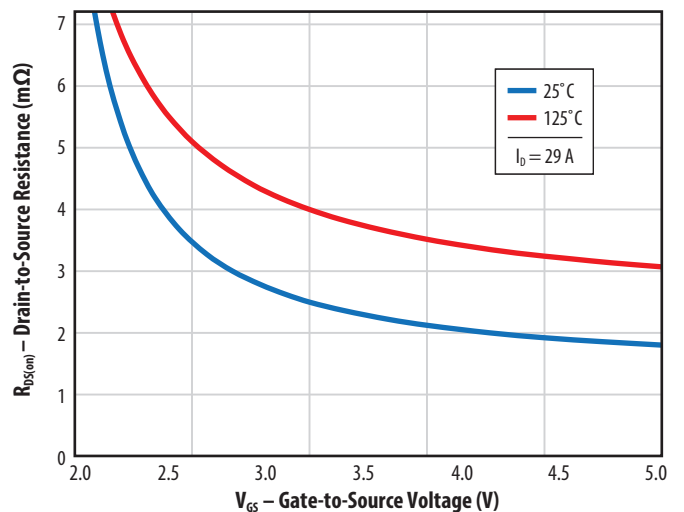


Figure 5a: Capacitance (Linear Scale)

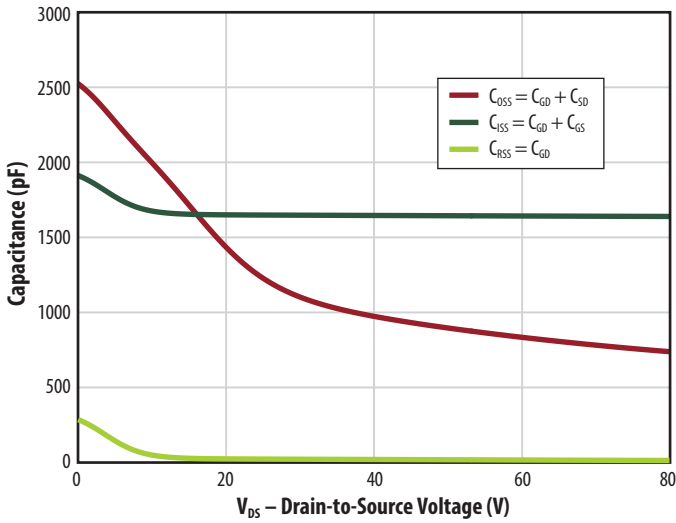


Figure 5b: Capacitance (Log Scale)

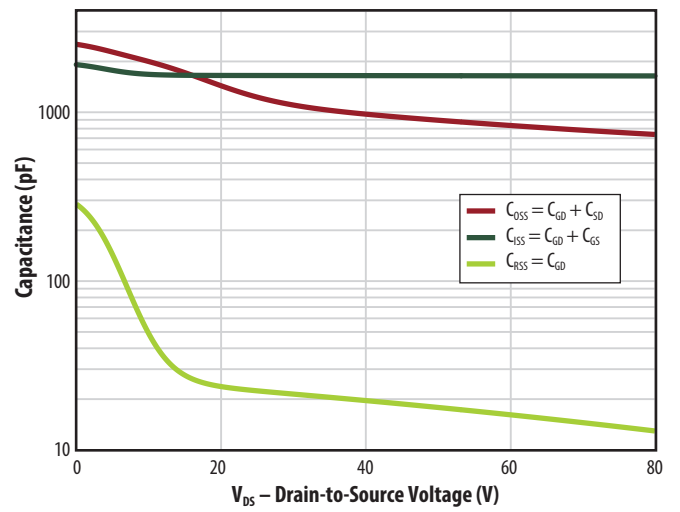


Figure 6: Gate Charge

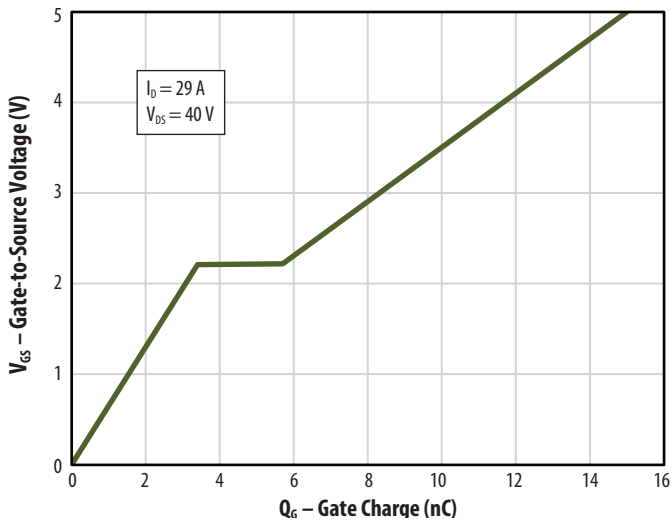


Figure 7: Reverse Drain-Source Characteristics

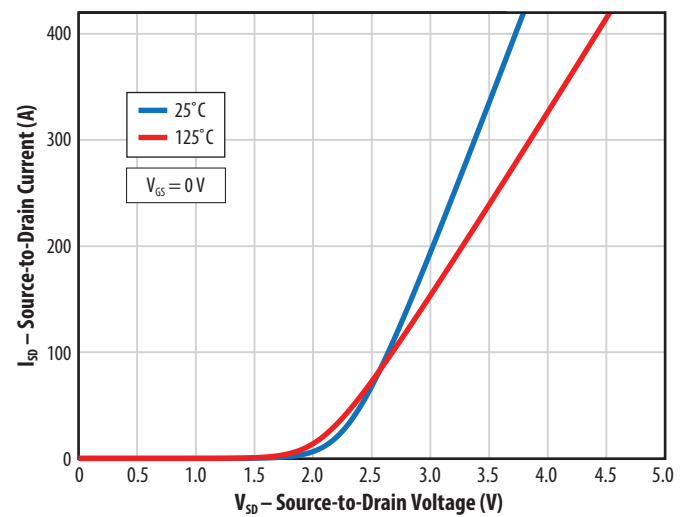


Figure 8: Normalized On-State Resistance vs. Temperature

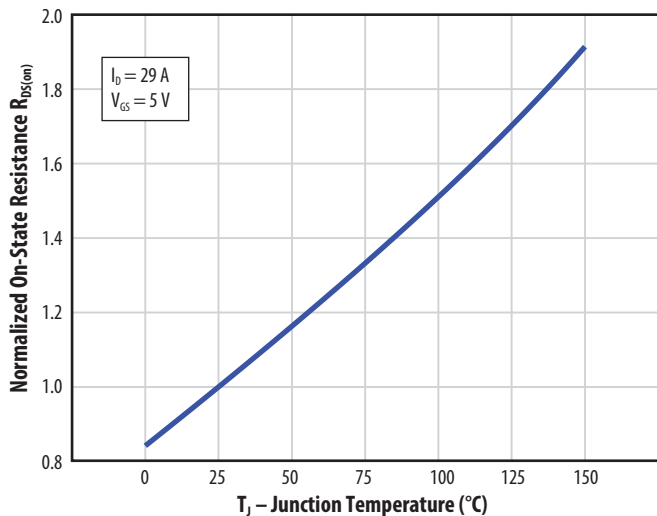
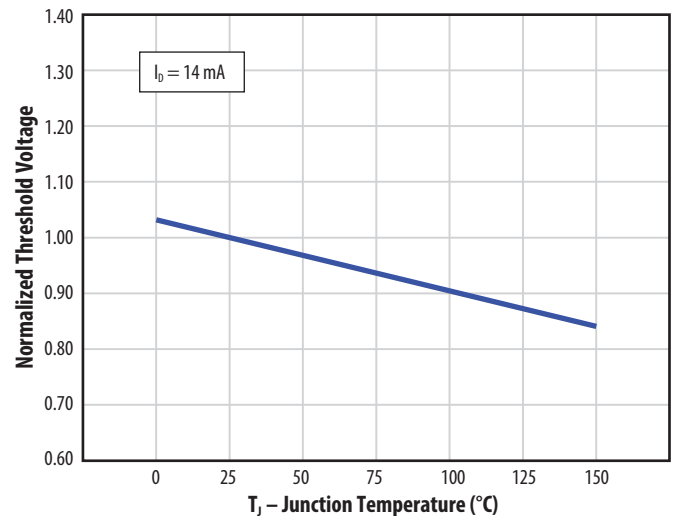


Figure 9: Normalized Threshold Voltage vs. Temperature



All measurements were done with substrate shorted to source.

Figure 10: Gate Leakage Current

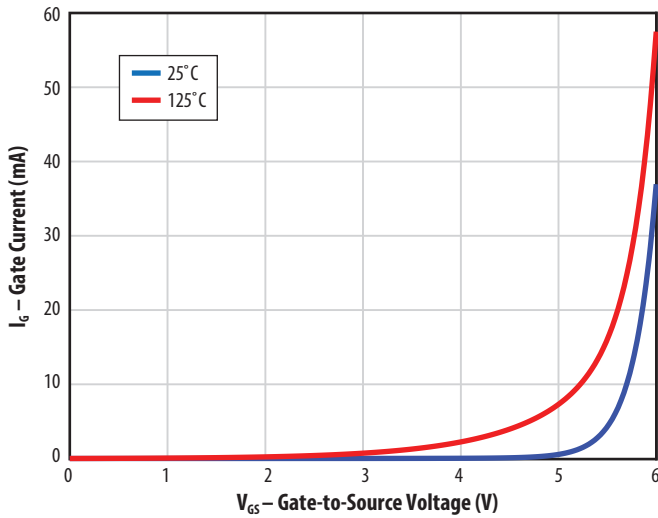


Figure 11: Safe Operating Area

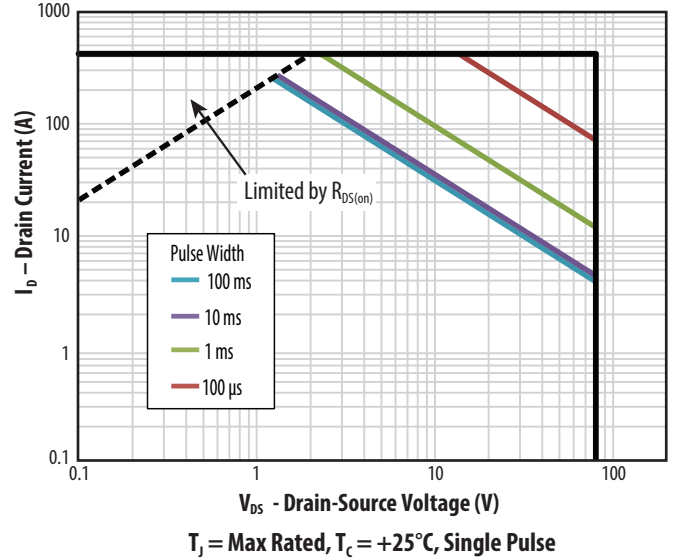
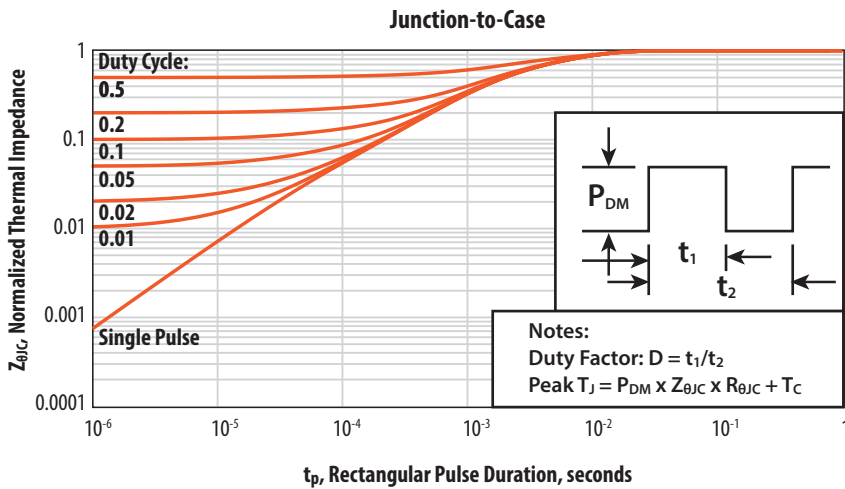
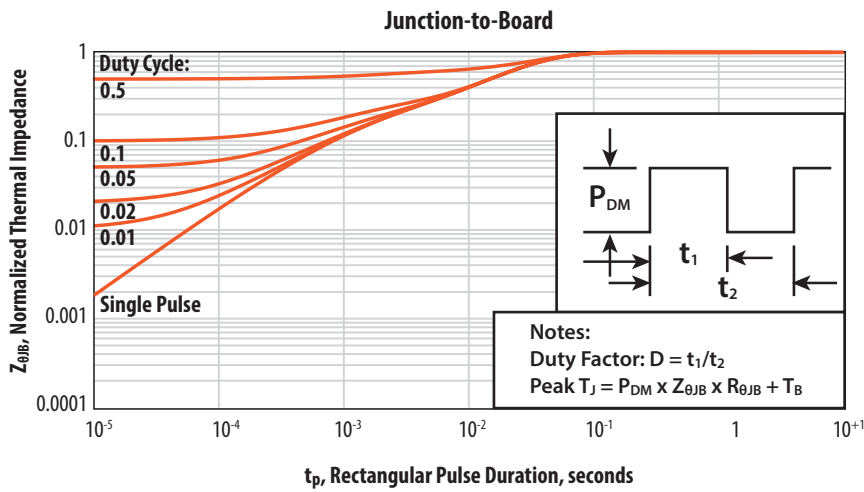
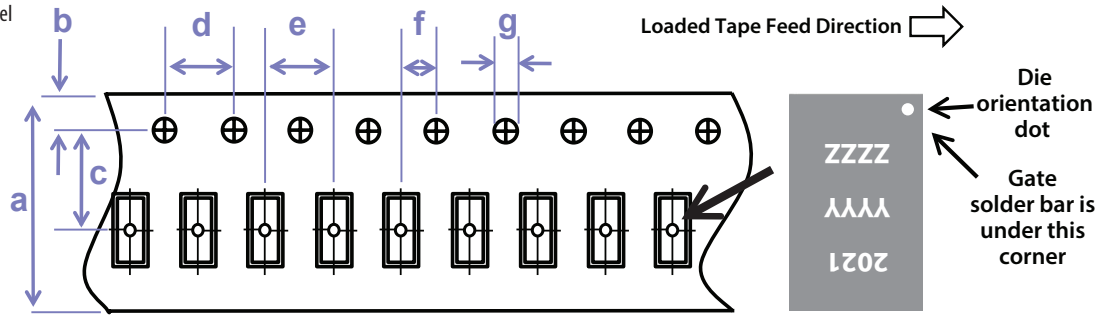
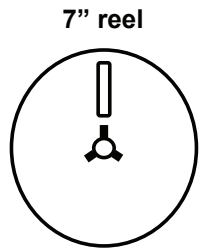


Figure 12: Transient Thermal Response Curves



**TAPE AND REEL CONFIGURATION**

4mm pitch, 12mm wide tape on 7" reel

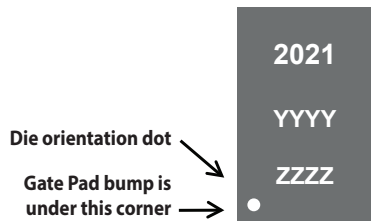


Die is placed into pocket solder bar side down (face side down)

Dimension (mm)	EPC2021 (note 1)		
	target	min	max
a	12.00	11.70	12.30
b	1.75	1.65	1.85
c (see note)	5.50	5.45	5.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (see note)	2.00	1.95	2.05
g	1.50	1.50	1.60

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.

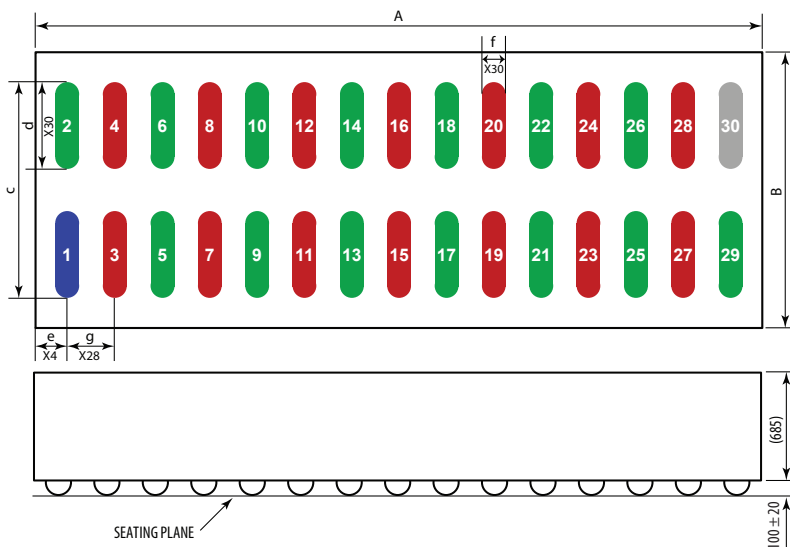
**DIE MARKINGS**



Part Number	Laser Marking		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2021	2021	YYYY	ZZZZ

**DIE OUTLINE**

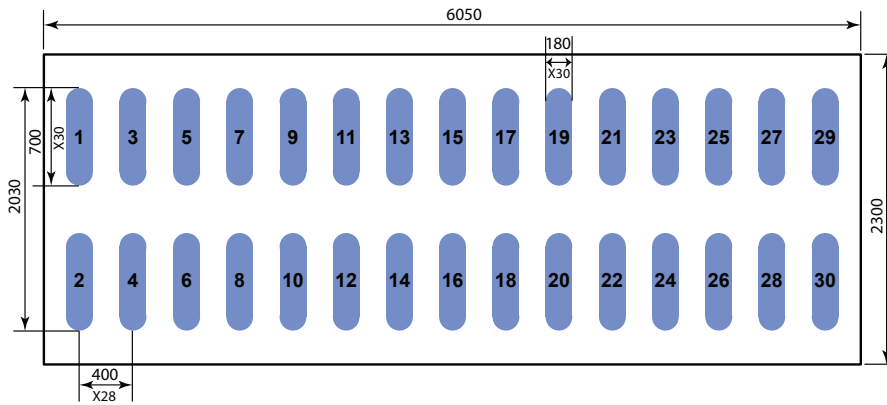
Solder Bump View



DIM	Micrometers		
	MIN	Nominal	MAX
A	6020	6050	6080
B	2270	2300	2330
c	2047	2050	2053
d	717	720	723
e	210	225	240
f	195	200	205
g	400	400	400

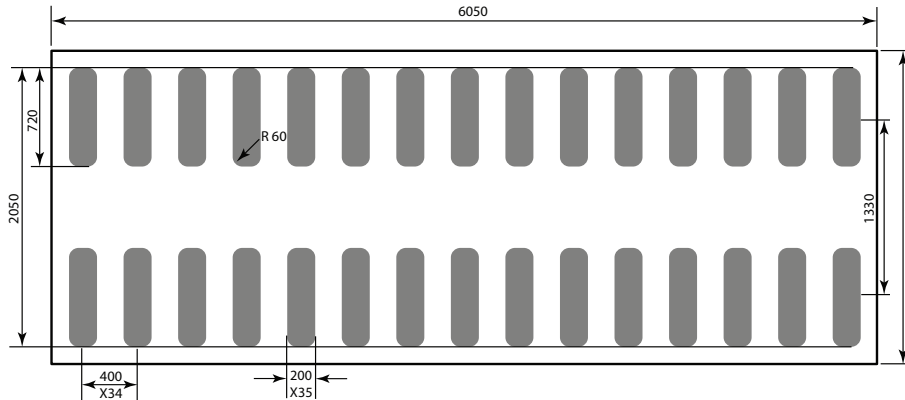
Pad 1 is Gate  
 Pads 2,5,6,9,10,13,14,17,18,21,22, 25,26,29 are Source  
 Pads 3,4,7,8,11,12,15,16,19,20,23, 24,27,28 are Drain  
 Pad 30 is Substrate

**RECOMMENDED LAND PATTERN**  
(units in  $\mu\text{m}$ )



Land pattern is solder mask defined  
Solder mask opening is 180  $\mu\text{m}$   
It is recommended to have on-Cu trace  
PCB vias

**RECOMMENDED STENCIL DRAWING**  
(units in  $\mu\text{m}$ )



Recommended stencil should be 4 mil (100  $\mu\text{m}$ ) 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 <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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