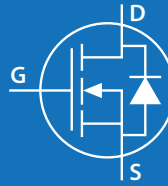


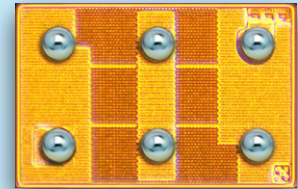
# EPC2051 – Enhancement Mode Power Transistor

 $V_{DS}, 100\text{ V}$ 
 $R_{DS(on)}, 25\text{ m}\Omega$ 
 $I_D, 1.7\text{ A}$ 


Revised October 12, 2021

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.

Questions:  
Ask a GaN  
Expert



Die Size: 1.3 x 0.85 mm

EPC2051 eGaN® FETs are supplied in passivated die form with copper pillars.

## Applications

- Open rack server architectures
- Lidar/pulsed power applications
- Power supplies
- Class D audio
- LED lighting
- Low inductance motor drive
- ToF module using Vcsel laser for camera modules, laptops and smart phones

## Benefits

- Ultra high efficiency
- No reverse recovery
- Ultra low  $Q_G$
- Ultra small footprint

Scan QR code or click link below for more information including reliability reports, device models, demo boards!



<https://l.ead.me/EPC2051>

Maximum Ratings			
PARAMETER		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage (Continuous)	100	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	120	
$I_D$	Continuous ( $T_A = 25^\circ\text{C}$ )	1.7	A
	Pulsed (25°C, $T_{PULSE} = 300\ \mu\text{s}$ )	37	
$V_{GS}$	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	3.8	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	16	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	92	

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](https://epc-co.com/epc/documents/product-training/Appnote_Thermal_Performance_of_eGaN_FETs.pdf) for details.

Static Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise stated)						
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$BV_{DSS}$	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}, I_D = 300\ \mu\text{A}$	100			V
$I_{DSS}$	Drain-Source Leakage	$V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$		4	250	$\mu\text{A}$
$I_{GSS}$	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}, T_J = 25^\circ\text{C}$		0.001	0.2	mA
	Gate-to-Source Forward Leakage <sup>#</sup>	$V_{GS} = 5\text{ V}, T_J = 125^\circ\text{C}$		0.04	2	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		4	250	$\mu\text{A}$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1.5\text{ mA}$	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}, I_D = 3\text{ A}$		20	25	m $\Omega$
$V_{SD}$	Source-Drain Forward Voltage <sup>#</sup>	$I_S = 0.5\text{ A}, V_{GS} = 0\text{ V}$		1.9		V

<sup>#</sup> Defined by design. Not subject to production test.

Dynamic Characteristics<sup>#</sup> (T<sub>J</sub> = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C <sub>ISS</sub>	Input Capacitance	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V		224	297	pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			1		
C <sub>OSS</sub>	Output Capacitance			86	129	
C <sub>OSS(ER)</sub>	Effective Output Capacitance, Energy Related (Note 2)	V <sub>DS</sub> = 0 to 50 V, V <sub>GS</sub> = 0 V		112		
C <sub>OSS(TR)</sub>	Effective Output Capacitance, Time Related (Note 3)			146		
R <sub>G</sub>	Gate Resistance			0.8		Ω
Q <sub>G</sub>	Total Gate Charge	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 3 A		1.8	2.3	nC
Q <sub>GS</sub>	Gate to Source Charge	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 3 A		0.6		
Q <sub>GD</sub>	Gate to Drain Charge			0.3		
Q <sub>G(TH)</sub>	Gate Charge at Threshold			0.4		
Q <sub>OSS</sub>	Output Charge	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 50 V		7.3	11	
Q <sub>RR</sub>	Source-Drain Recovery Charge			0		

# Defined by design. Not subject to production test.

All measurements were done with substrate connected to source.

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>DSS</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>DSS</sub>.

Figure 1: Typical Output Characteristics at 25°C

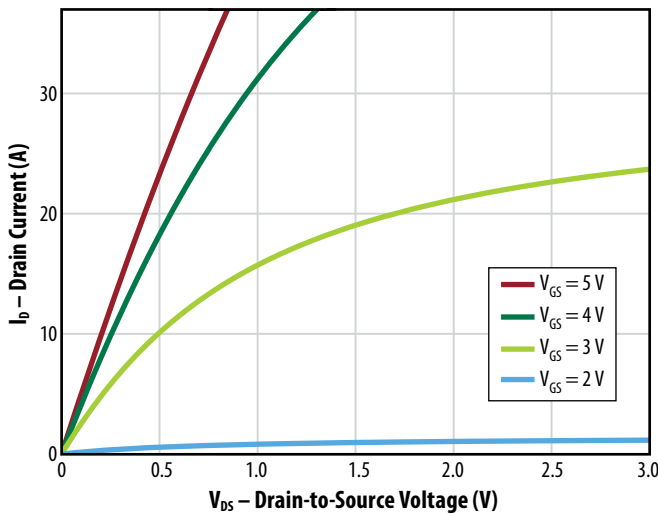


Figure 2: Typical Transfer Characteristics

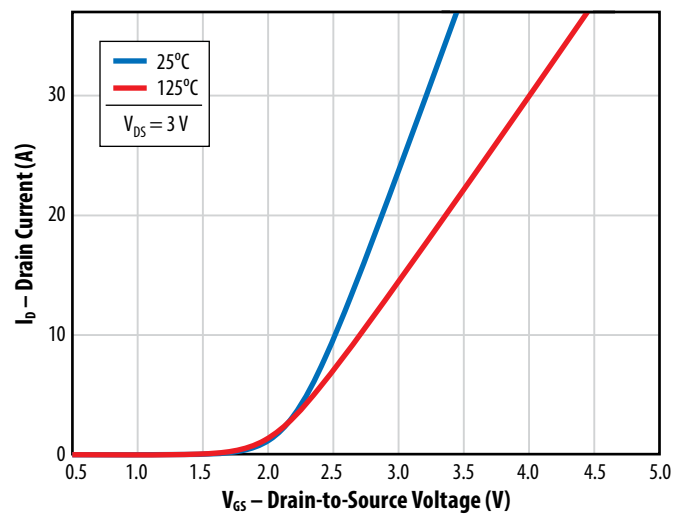


Figure 3: Typical R<sub>DS(on)</sub> vs. V<sub>GS</sub> for Various Currents

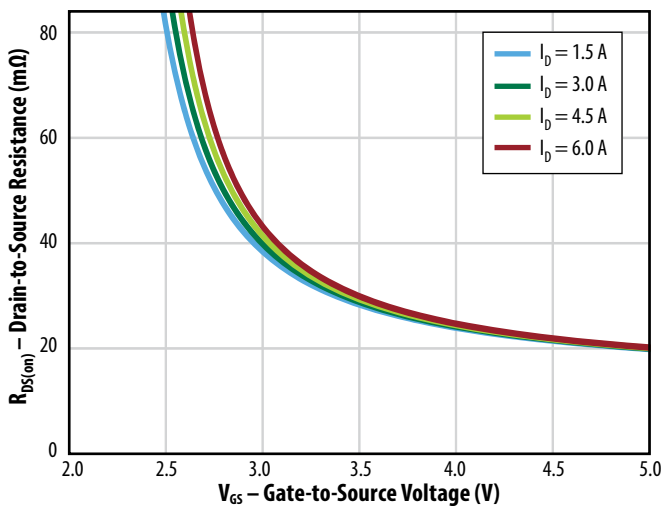


Figure 4: Typical R<sub>DS(on)</sub> vs. V<sub>GS</sub> for Various Temperatures

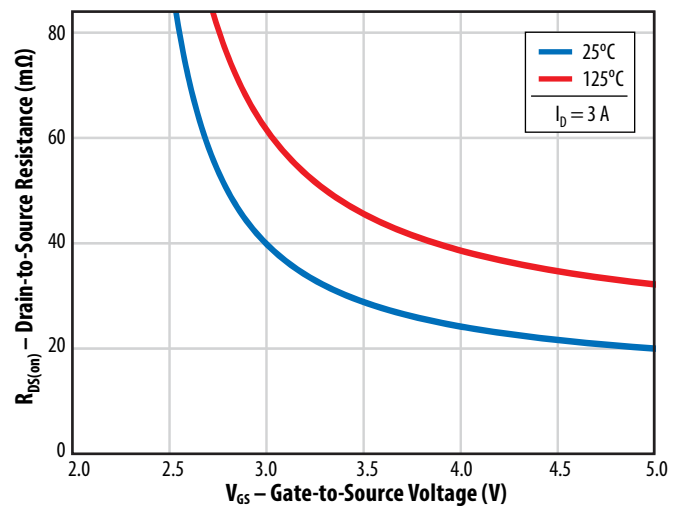


Figure 5a: Typical Capacitance (Linear Scale)

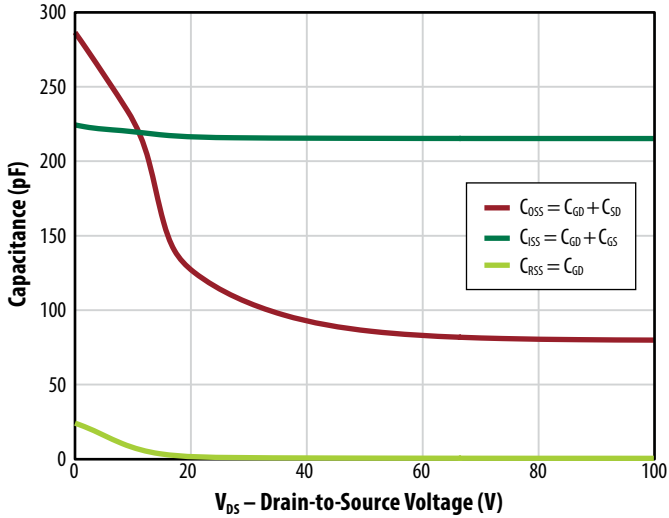


Figure 5b: Typical Capacitance (Log Scale)

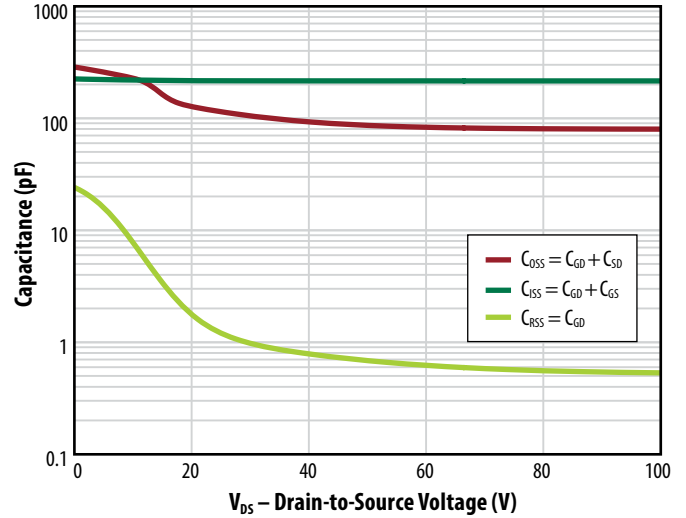


Figure 6: Typical Output Charge and  $C_{OSS}$  Stored Energy

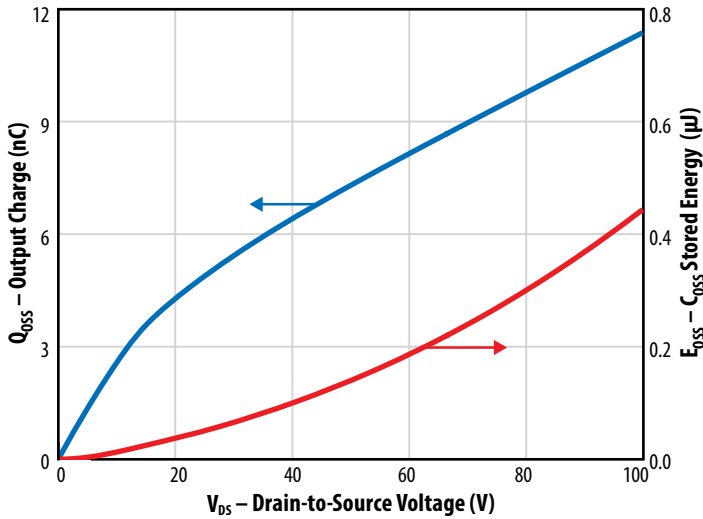


Figure 7: Typical Gate Charge

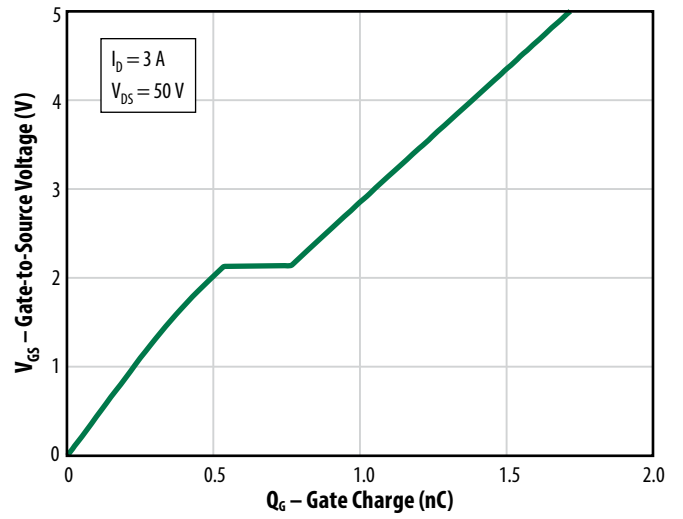


Figure 8: Typical Reverse Drain-Source Characteristics

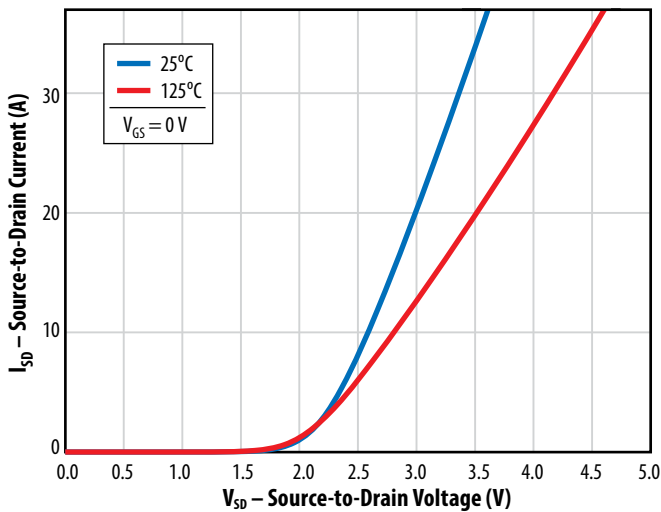
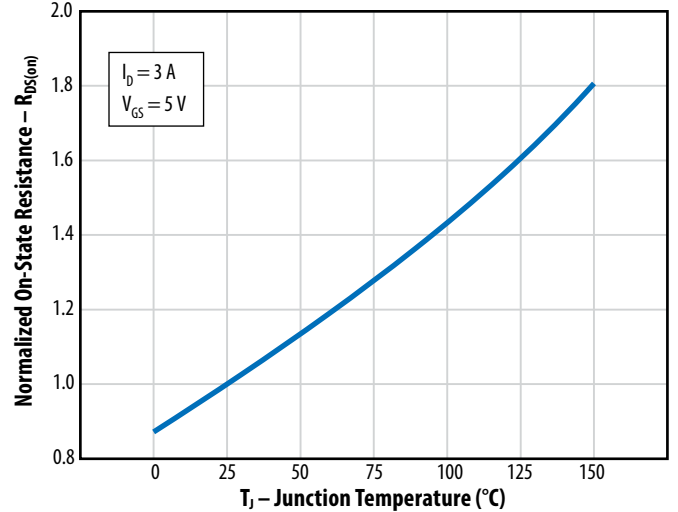


Figure 9: Typical Normalized On-State Resistance vs. Temp.



Note: Negative gate drive voltage increases the reverse drain-source voltage. EPC recommends 0V for OFF.

Figure 10: Typical Normalized Threshold Voltage vs. Temp.

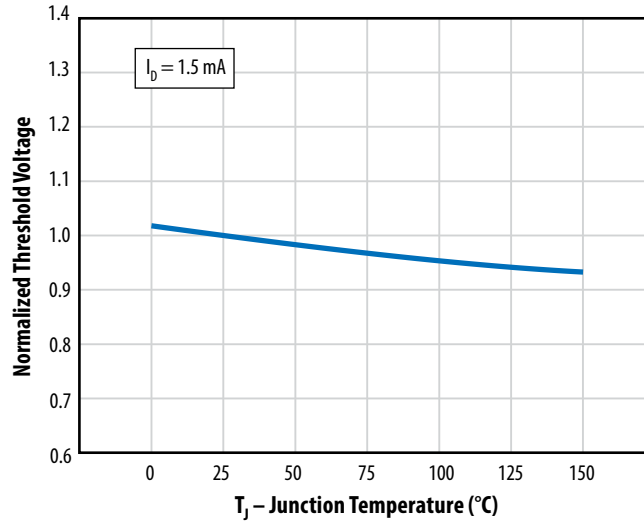


Figure 11: Typical Transient Thermal Response Curves

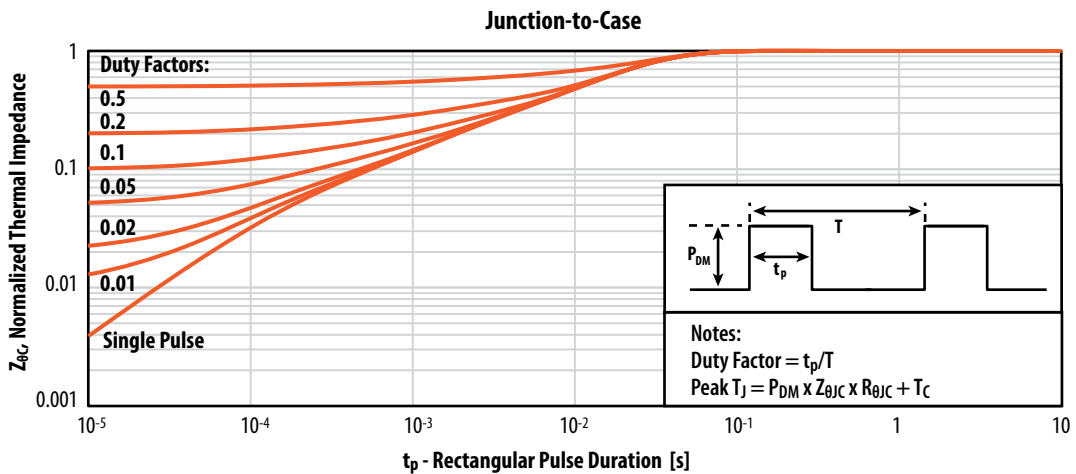
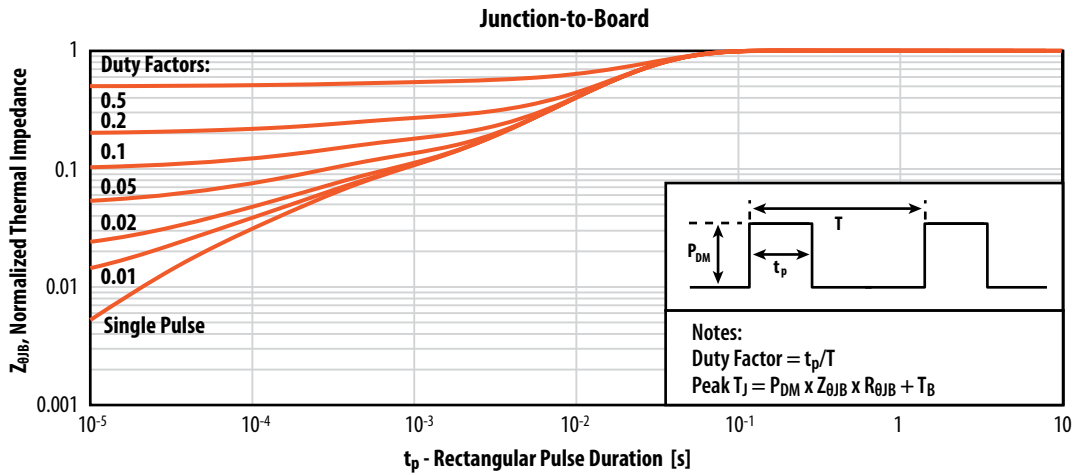
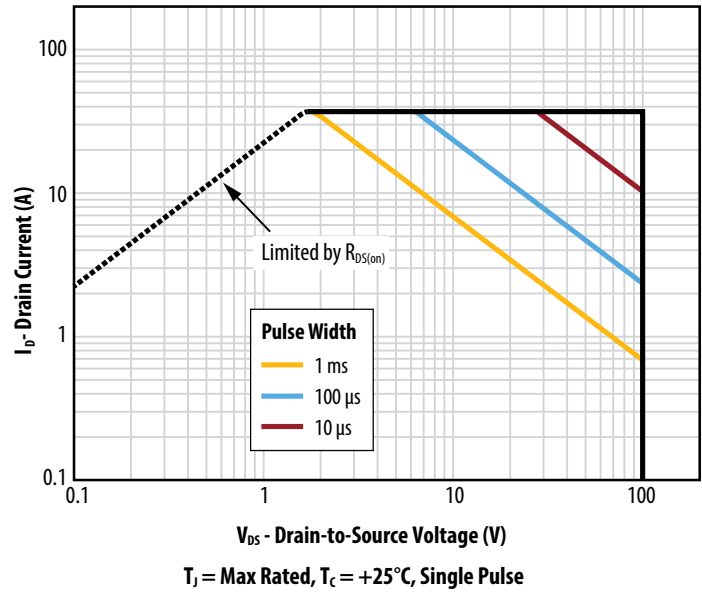
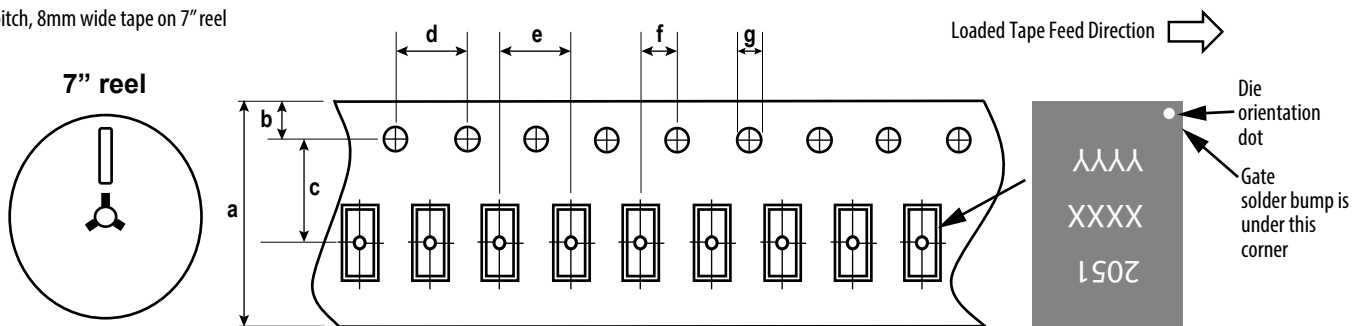


Figure 12: Safe Operating Area



TAPE AND REEL CONFIGURATION

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

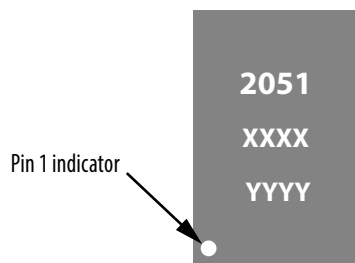


EPC2051 (Note 1)	Dimension (mm)		
	Target	MIN	MAX
<b>a</b>	8.00	7.90	8.30
<b>b</b>	1.75	1.65	1.85
<b>c</b> (Note 2)	3.50	3.45	3.55
<b>d</b>	4.00	3.90	4.10
<b>e</b>	4.00	3.90	4.10
<b>f</b> (Note 2)	2.00	1.95	2.05
<b>g</b>	1.50	1.50	1.60

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.

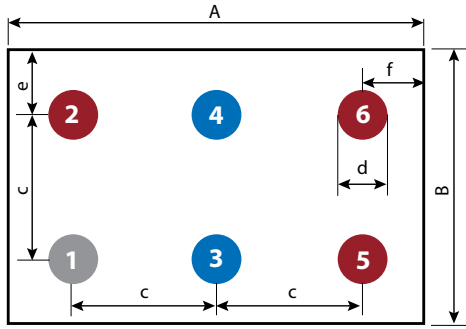
DIE MARKINGS



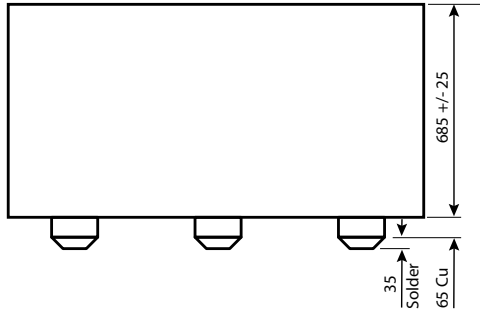
Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2051	2051	XXXX	YYYY

**DIE OUTLINE**

Solder Bar View  
(looking at the Cu pillars)



Side View

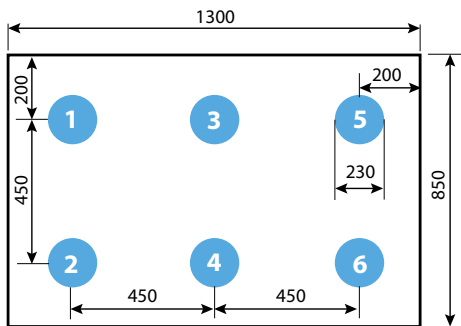


DIM	MICROMETERS		
	MIN	Nominal	MAX
A	1270	1300	1330
B	820	850	880
c		450	
d		150	
e	185	200	215
f	185	200	215

Pad 1 is Gate;  
**Pads 2, 5, 6 are Source;**  
**Pads 3 & 4 are Drain**

**RECOMMENDED LAND PATTERN**

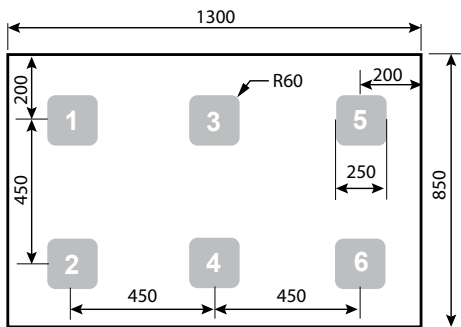
(units in  $\mu\text{m}$ )



Pad 1 is Gate;  
 Pads 2, 5, 6 are Source;  
 Pads 3 & 4 are Drain

**RECOMMENDED STENCIL DRAWING**

(measurements in  $\mu\text{m}$ )



**Preliminary Solder Flux Recommendation:**

EPC uses Kester NP505-HR Type 4 Solder Paste. This solder uses ROLO type flux. It is intended that the solder completely wets the sides of the Cu Pillar. This is different from traditional Cu Pillar assembly techniques.

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

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