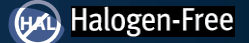




THE DATASHEET OF EPC2051



EPC2051 – Enhancement Mode Power Transistor

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


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)	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 ($25^\circ\text{C}, T_{PULSE} = 300\ \mu\text{s}$)	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

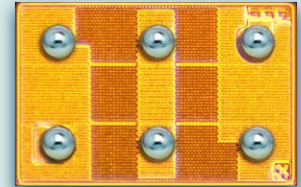
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.8	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	16	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	92	

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 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	μA
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 [#]	$V_{GS} = 5\text{ V}, T_J = 125^\circ\text{C}$		0.04	2	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		4	250	μA
$V_{GS(TH)}$	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 Ω
V_{SD}	Source-Drain Forward Voltage	$I_S = 0.5\text{ A}, V_{GS} = 0\text{ V}$		1.9		V

[#] Defined by design. Not subject to production test.



EPC2051 eGaN® FETs are supplied in passivated die form with copper pillars. Die size: 1.3 mm x 0.85 mm

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



Dynamic Characteristics ($T_j = 25^\circ\text{C}$ unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance [#]	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		224	297	pF
C_{RSS}	Reverse Transfer Capacitance			1		
C_{OSS}	Output Capacitance [#]			86	129	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0\text{ V}$		112		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			146		
R_G	Gate Resistance			0.8		Ω
Q_G	Total Gate Charge [#]	$V_{DS} = 50\text{ V}, V_{GS} = 5\text{ V}, I_D = 3\text{ A}$		1.8	2.3	nC
Q_{GS}	Gate to Source Charge	$V_{DS} = 50\text{ V}, I_D = 3\text{ A}$		0.6		
Q_{GD}	Gate to Drain Charge			0.3		
$Q_{G(TH)}$	Gate Charge at Threshold			0.4		
Q_{OSS}	Output Charge [#]	$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}$		7.3	11	
Q_{RR}	Source-Drain Recovery Charge			0		

Defined by design. Not subject to production test.

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: Typical Output Characteristics at 25°C

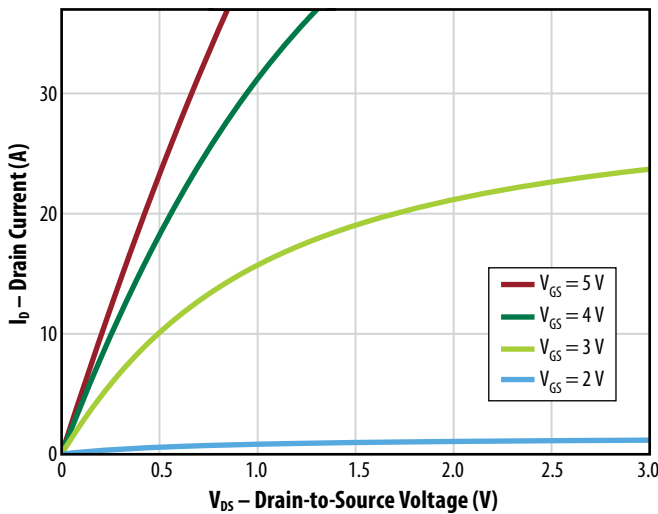


Figure 2: Transfer Characteristics

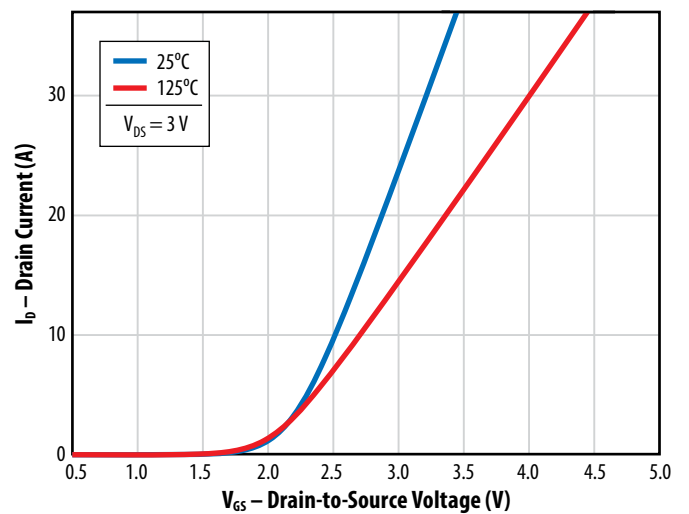


Figure 3: $R_{DS(on)}$ vs. V_{GS} for Various Currents

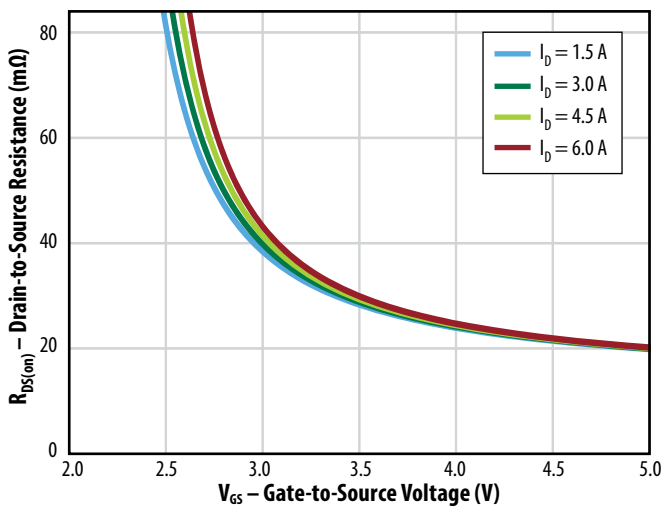


Figure 4: $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

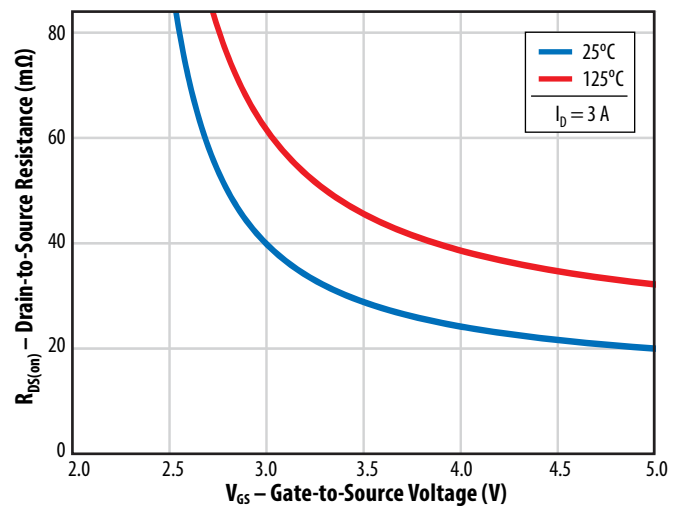


Figure 5a: Capacitance (Linear Scale)

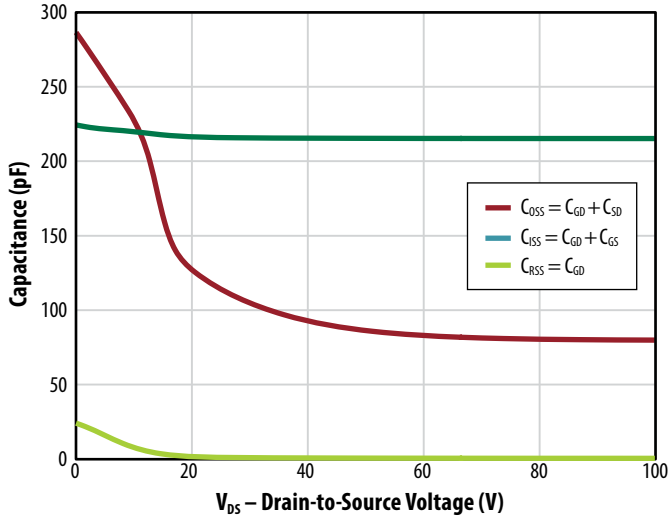


Figure 5b: Capacitance (Log Scale)

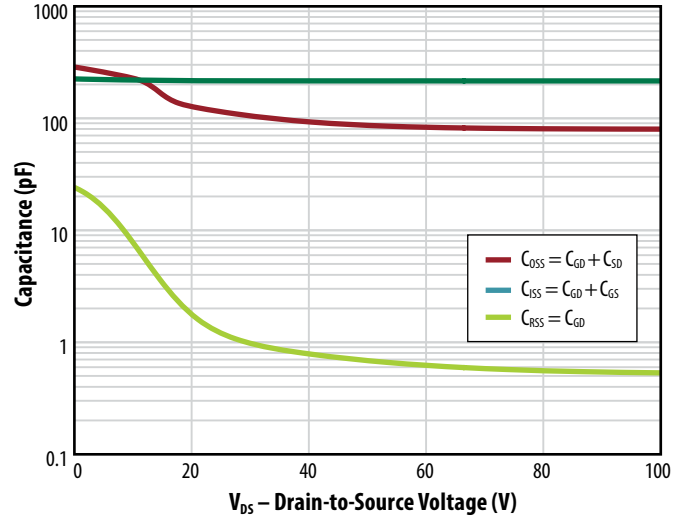


Figure 6: Output Charge and C_{OSS} Stored Energy

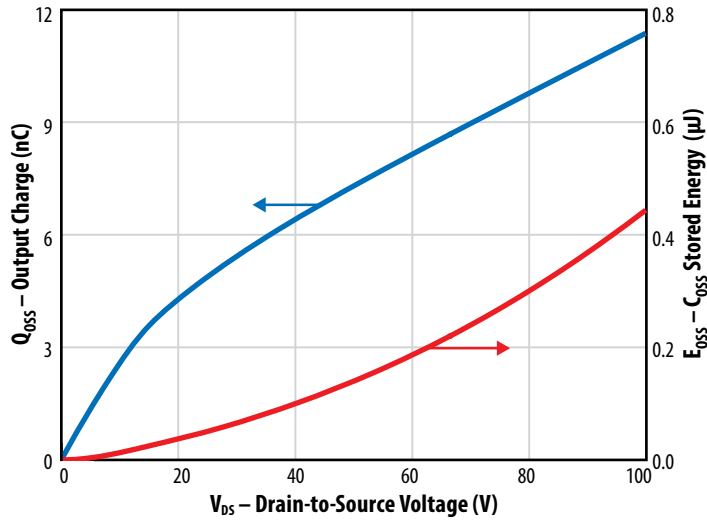


Figure 7: Gate Charge

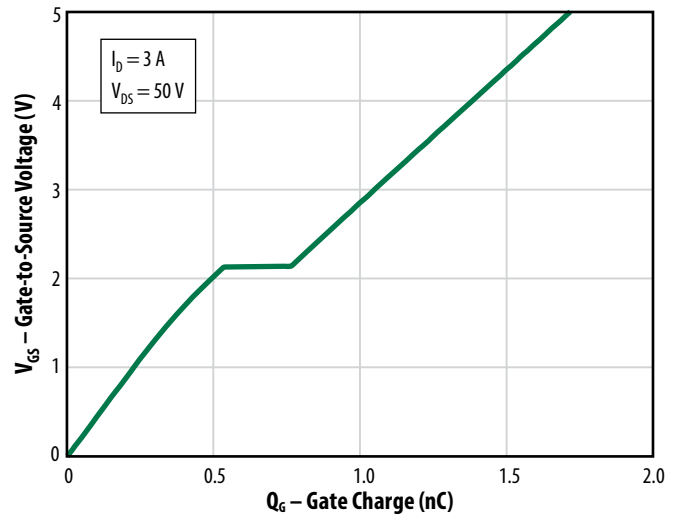


Figure 8: Reverse Drain-Source Characteristics

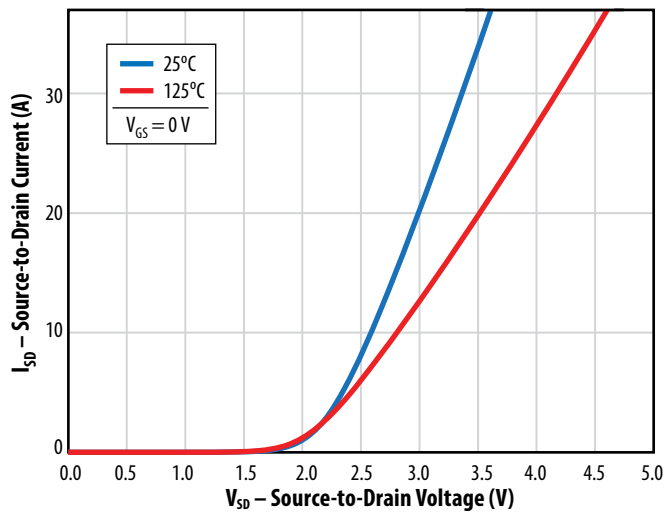


Figure 9: Normalized On-State Resistance vs. Temperature

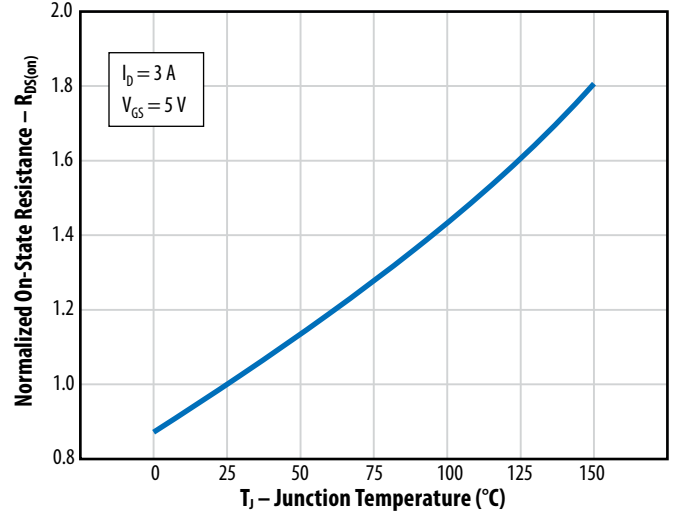


Figure 10: Normalized Threshold Voltage vs. Temperature

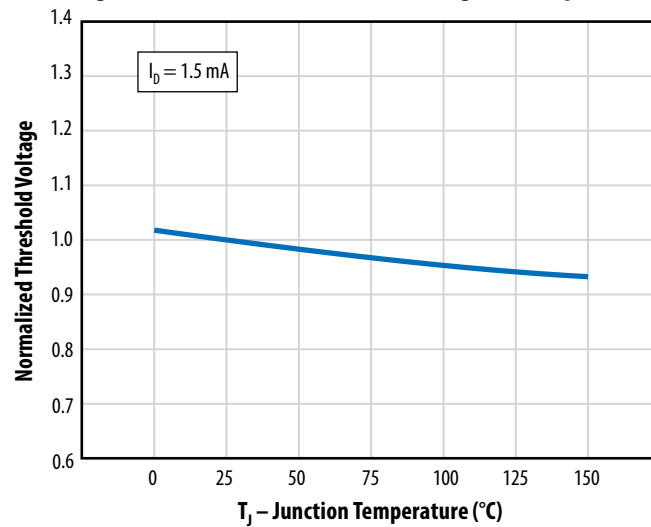


Figure 11: Transient Thermal Response Curves

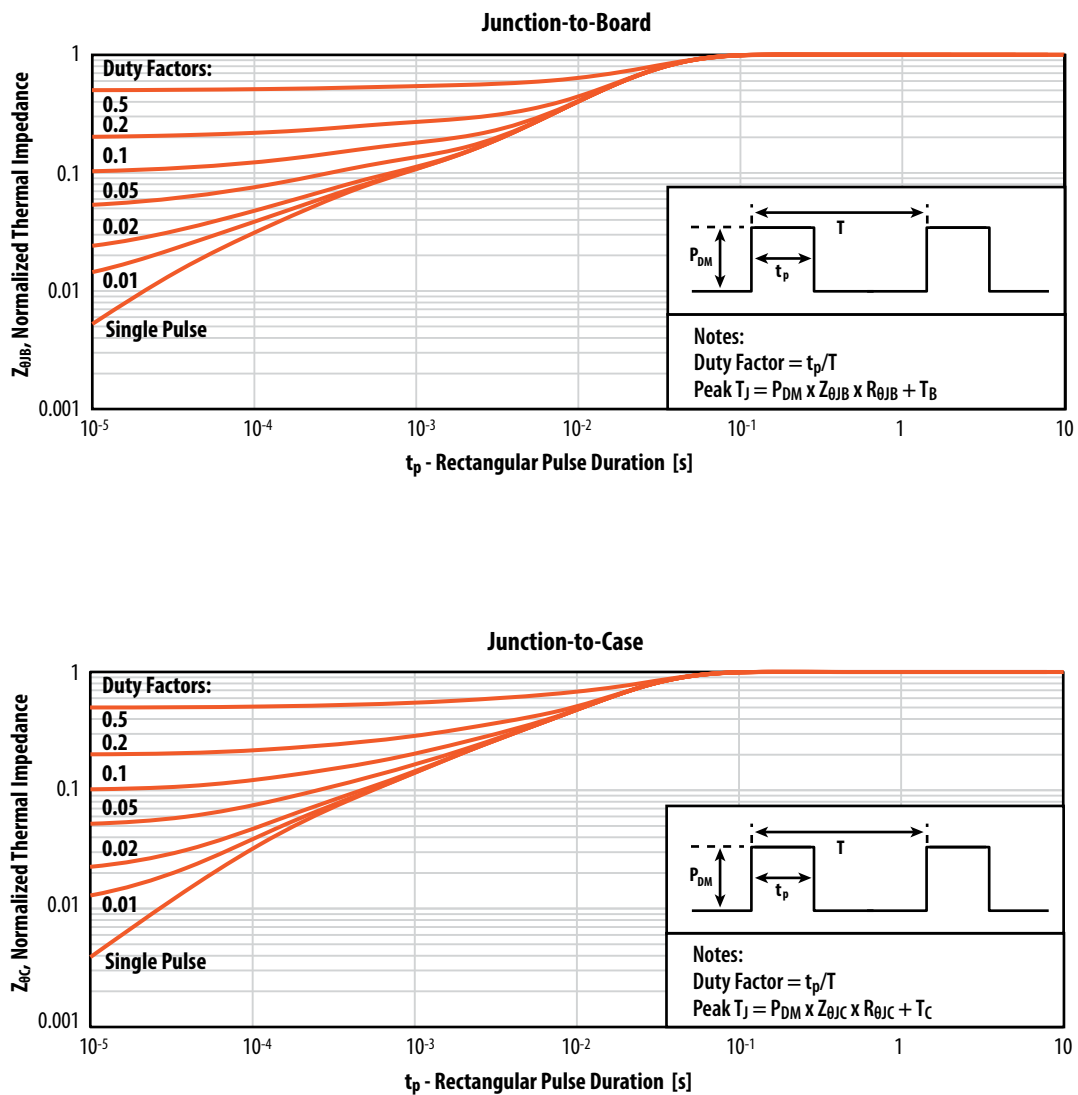
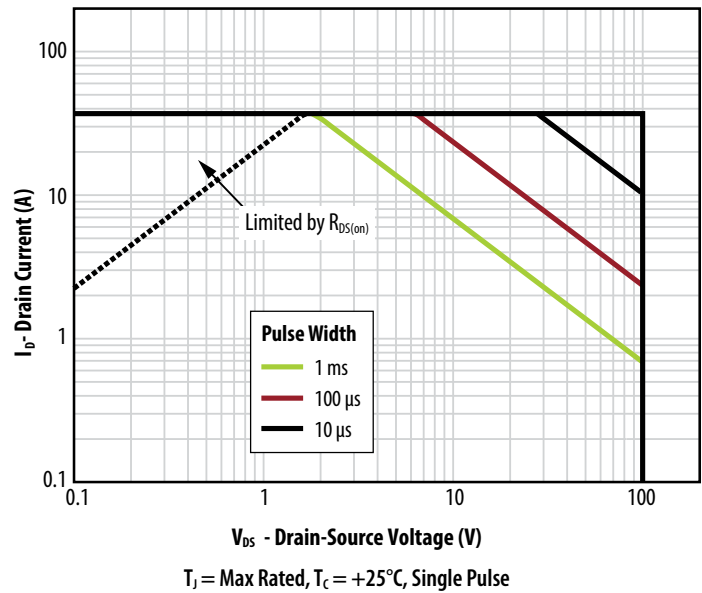
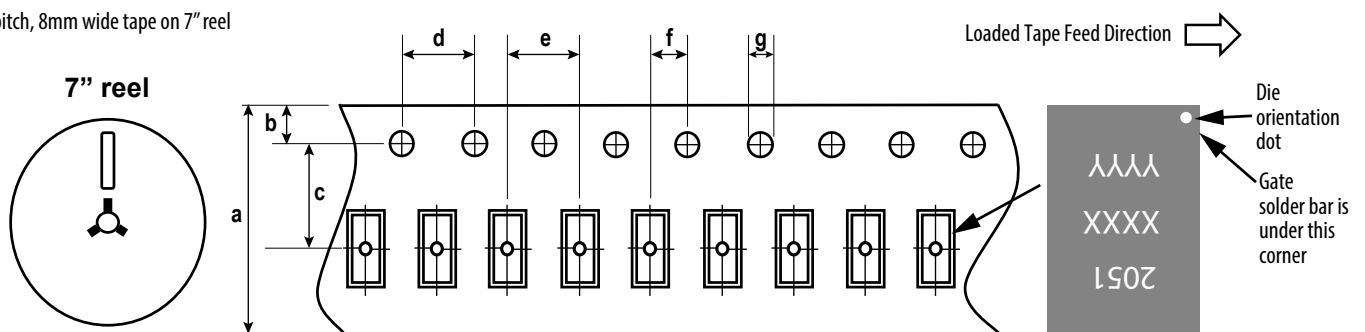


Figure 12: Safe Operating Area



TAPE AND REEL CONFIGURATION

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

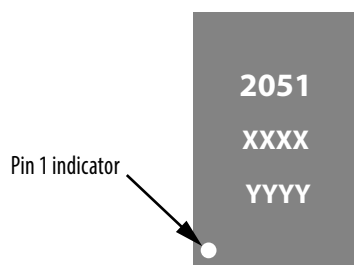


EPC2070 (Note 1)	Dimension (mm)		
	Target	MIN	MAX
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (Note 2)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (Note 2)	2.00	1.95	2.05
g	1.50	1.50	1.60

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.

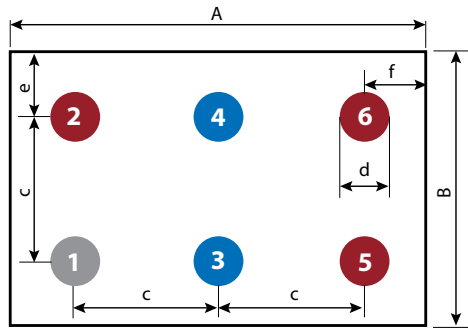
DIE MARKINGS



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

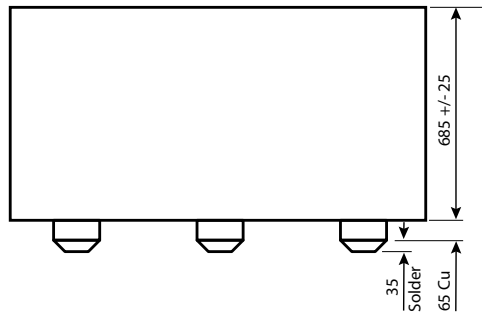
DIE OUTLINE

Solder Bar View
(looking at the Cu pillars)



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

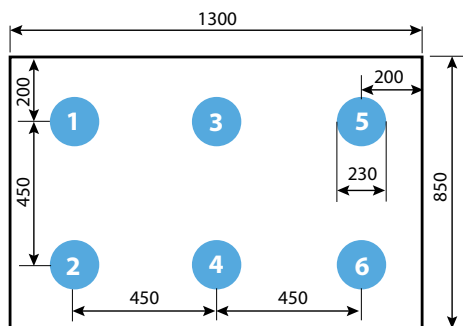
Side View



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

RECOMMENDED LAND PATTERN

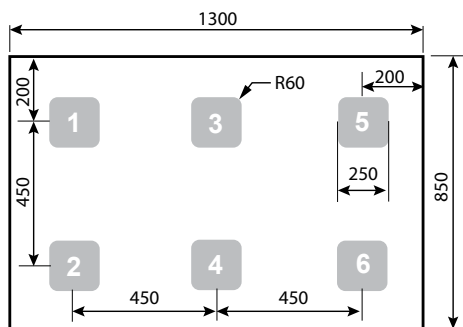
(units in μm)



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

RECOMMENDED STENCIL DRAWING

(measurements in μm)



Preliminary Solder Flux Recommendation:

EPC uses Kester NP505-HR Type 4 Solder Paste. This solder uses ROL0 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/DesignSupport/AssemblyBasics.aspx>

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Revised October, 2021

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