

EPC2019 – Enhancement Mode Power Transistor

 V_{DS} , 200 V $R_{DS(on)}$, 42 mΩ max I_D , 8.5 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.

APPLICATION NOTES:

- Easy-to-use and reliable gate, Gate Drive ON = 5 V typical, OFF = 0 V (negative voltage not needed)
- Top of FET is electrically connected to source
- Questions: **Ask a GaN Expert**



Maximum Ratings			
PARAMETER		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	200	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	240	
I_D	Continuous ($T_A = 25^\circ\text{C}$, $R_{\theta JA} = 18^\circ\text{C/W}$)	8.5	A
	Pulsed (25°C , $T_{PULSE} = 300 \mu\text{s}$)	45	
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	2.7	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	7.5	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	72	

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	$V_{GS} = 0 \text{ V}$, $I_D = 125 \mu\text{A}$	200			V
I_{DSS}	Drain-Source Leakage	$V_{GS} = 0 \text{ V}$, $V_{DS} = 160 \text{ V}$		1	100	μA
I_{GSS}	Gate-to-Source Forward Leakage	$V_{GS} = 5 \text{ V}$		0.001	2.5	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4 \text{ V}$		1	100	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	$V_{GS} = 5 \text{ V}$, $I_D = 7 \text{ A}$		22	42	mΩ
V_{SD}	Source-Drain Forward Voltage [#]	$I_S = 0.5 \text{ A}$, $V_{GS} = 0 \text{ V}$		2.0		V

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



EPC2019 eGaN® FETs are supplied only in passivated die form with solder bars
Die size: 2.77 x 0.95 mm

Applications

- High Speed DC-DC conversion
- Class-D Audio
- High Frequency Hard-Switching and Soft-Switching Circuits

Benefits

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



Dynamic Characteristics# (T_j = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C _{ISS}	Input Capacitance	V _{GS} = 0 V, V _{DS} = 100 V		254	288	pF
C _{RSS}	Reverse Transfer Capacitance			1.3		
C _{OSS}	Output Capacitance			135	163	
C _{OSS(ER)}	Effective Output Capacitance, Energy Related (Note 2)	V _{GS} = 0 V, V _{DS} = 0 to 100 V		156		
C _{OSS(TR)}	Effective Output Capacitance, Time Related (Note 3)			201		
R _G	Gate Resistance			0.4		Ω
Q _G	Total Gate Charge	V _{GS} = 5 V, V _{DS} = 100 V, I _D = 7 A		2.4	2.9	nC
Q _{GS}	Gate-to-Source Charge	V _{DS} = 100 V, I _D = 7 A		0.8		
Q _{GD}	Gate-to-Drain Charge			0.6		
Q _{G(TH)}	Gate Charge at Threshold			0.6		
Q _{OSS}	Output Charge	V _{GS} = 0 V, V _{DS} = 100 V		20	24	
Q _{RR}	Source-Drain Recovery Charge			0		

All measurements were done with substrate connected to source.

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

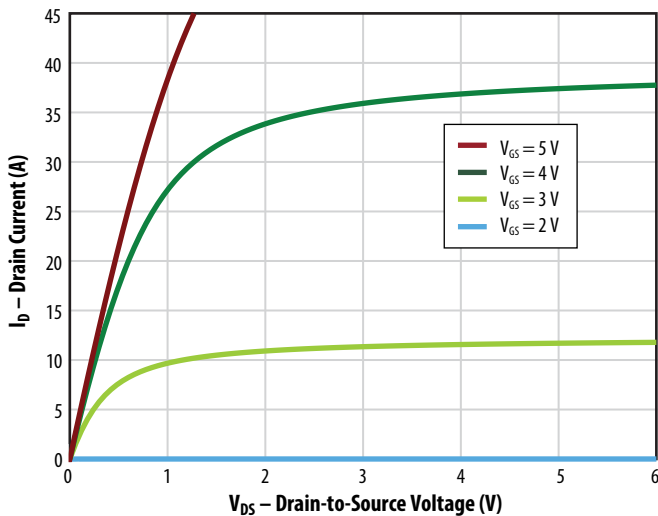


Figure 2: Typical Transfer Characteristics

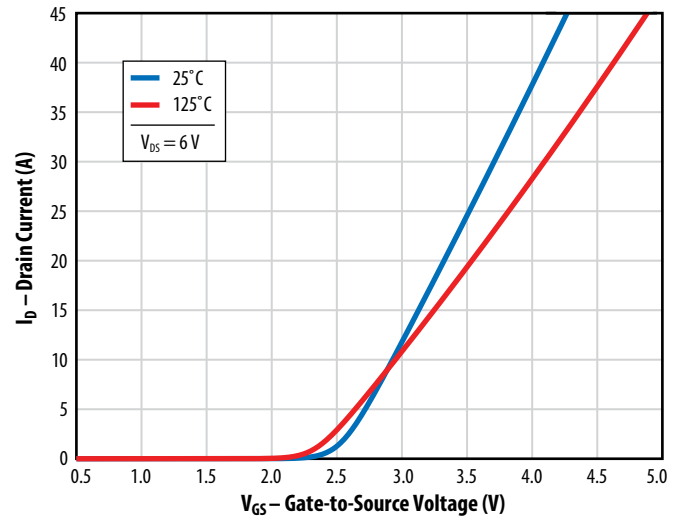


Figure 3: R_{DS(on)} vs. V_{GS} for Various Drain Currents

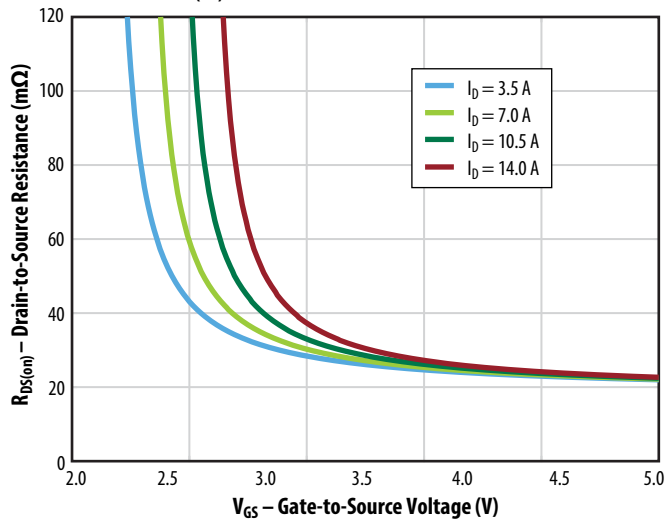


Figure 4: Typical R_{DS(on)} vs. V_{GS} for Various Temperatures

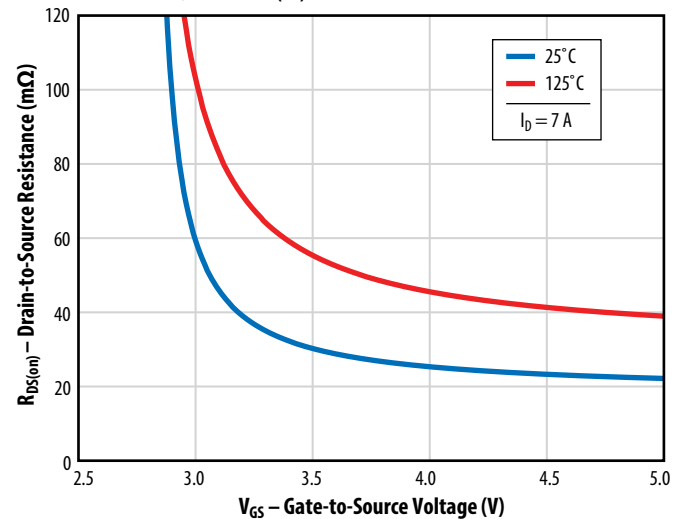


Figure 5a: Typical Capacitance (Linear Scale)

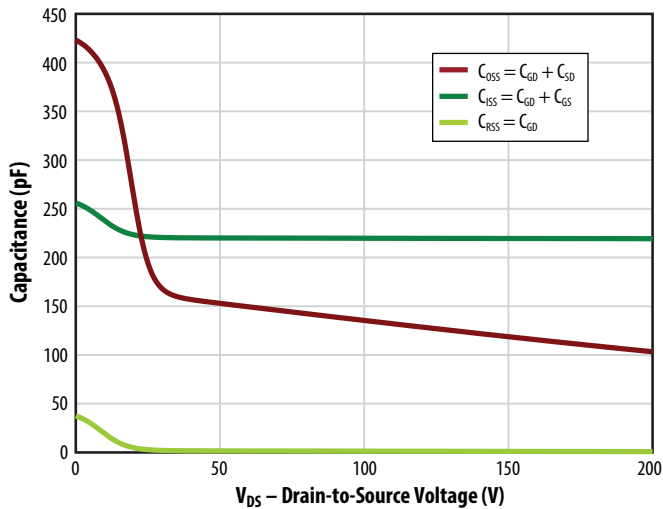


Figure 5b: Typical Capacitance (Log Scale)

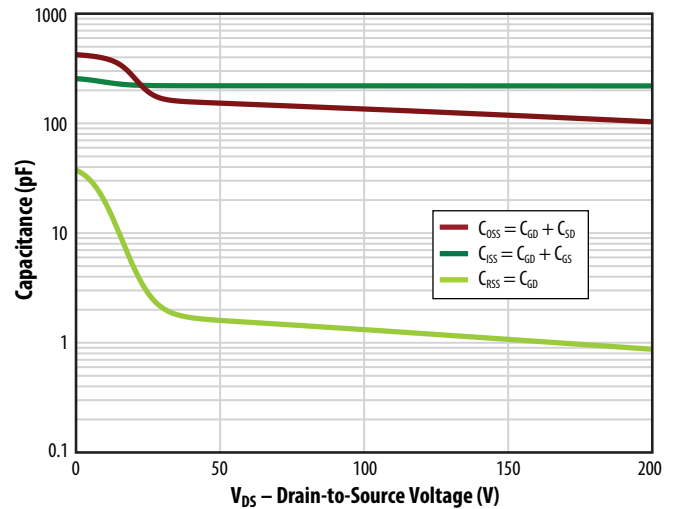


Figure 6: Typical Output Charge and C_oss Stored Energy

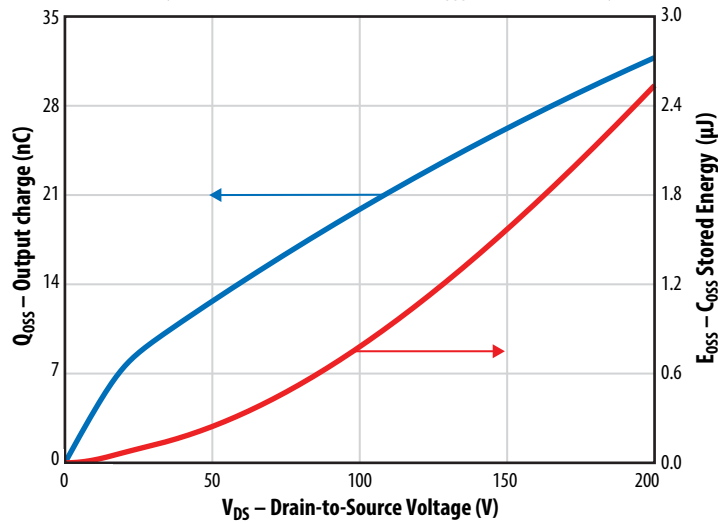


Figure 7: Typical Gate Charge

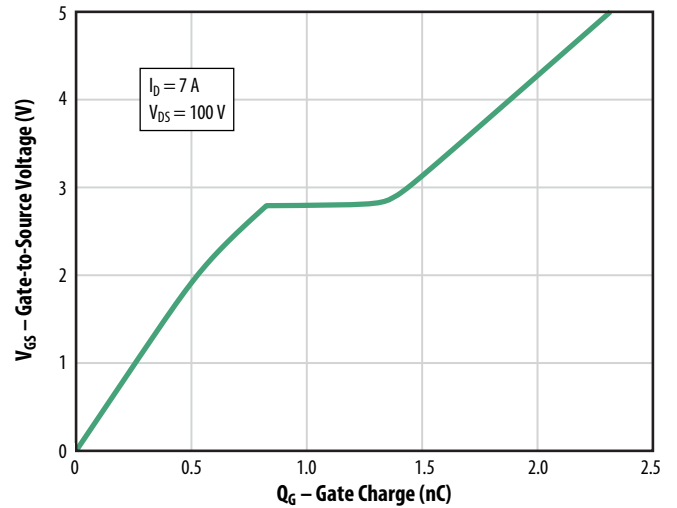


Figure 8: Reverse Drain-Source Characteristics

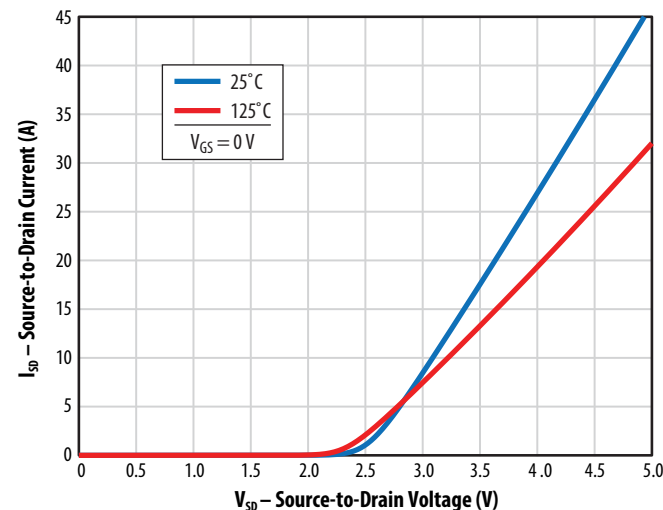
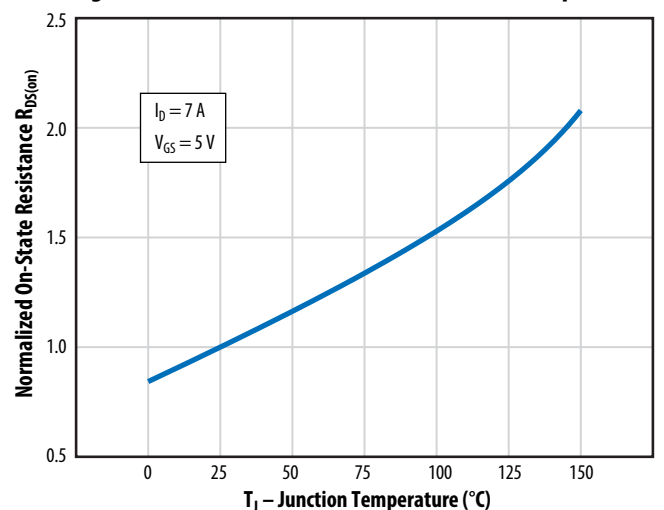


Figure 9: Normalized On-State Resistance vs. Temperature



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

Figure 10: Normalized Threshold Voltage vs. Temperature

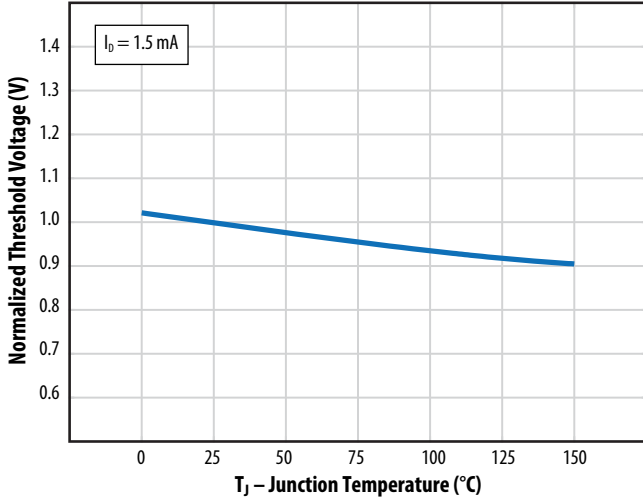


Figure 11: Safe Operating Area

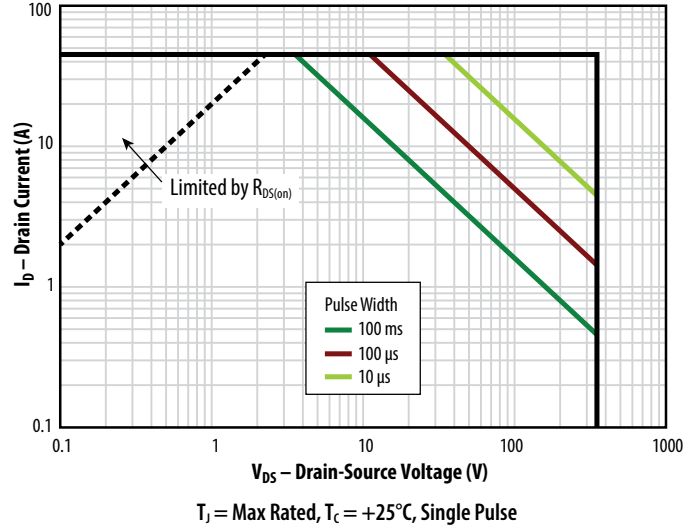
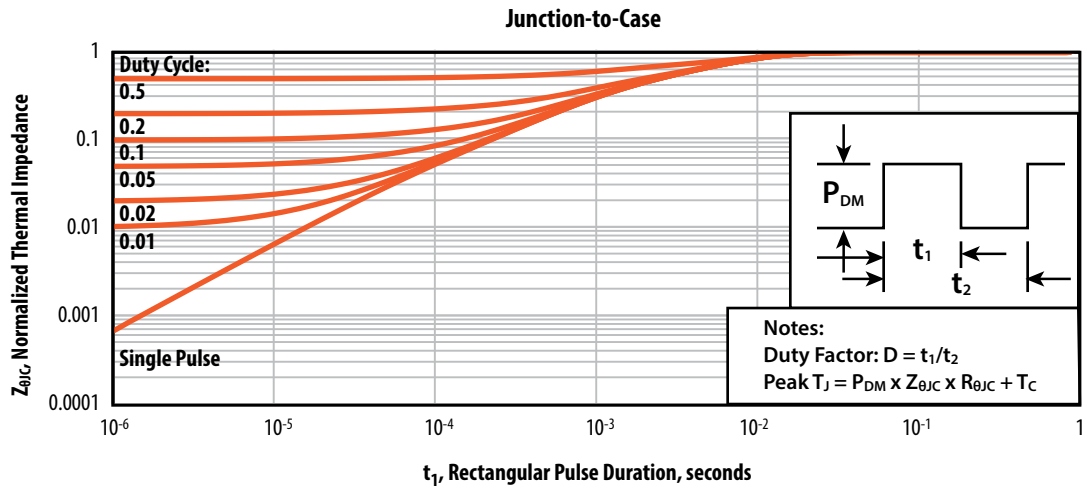
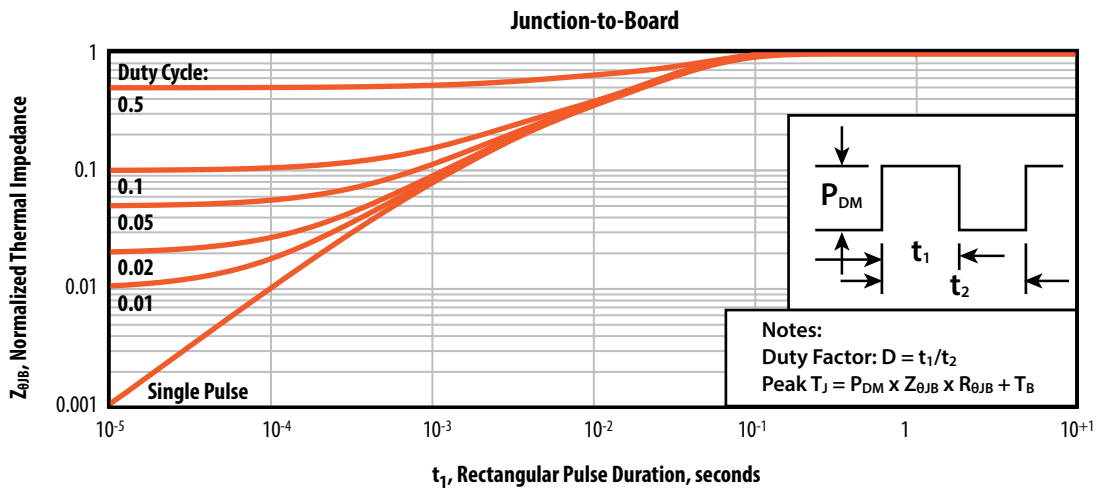
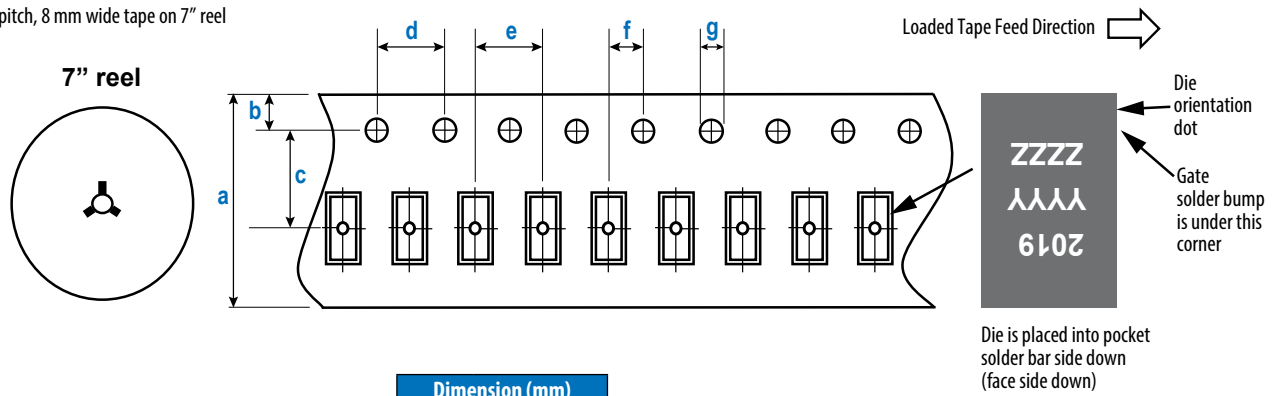


Figure 12: Transient Thermal Response Curves



TAPE AND REEL CONFIGURATION

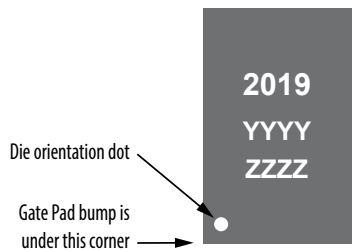
4 mm pitch, 8 mm wide tape on 7" reel



EPC2019 (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	1.40	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.

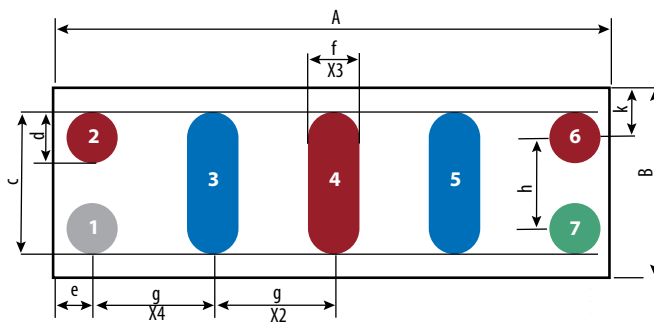
DIE MARKINGS



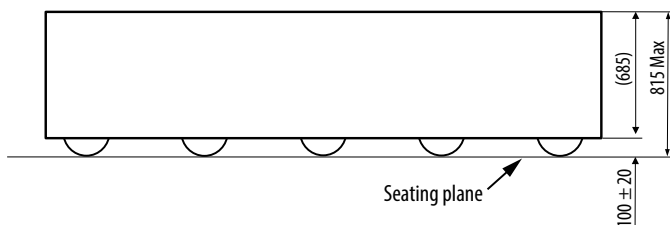
Part Number	Laser Markings		
	Part # Marking Line 1	Lot Date Code Marking Line 2	Lot Date Code Marking Line 3
EPC2019	2019	YYYY	ZZZZ

DIE OUTLINE

Solder Bar View



Side View



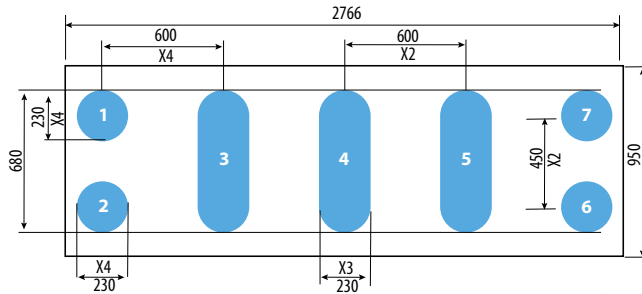
DIM	MICROMETERS		
	MIN	Nominal	MAX
A	2736	2766	2796
B	920	950	980
c	697	700	703
d	247	250	253
e	168	183	198
f	245	250	255
g	600	600	600
h	450	450	450
i	235	250	265

Pad no.1 is Gate;
 Pad no. 3, 5 are Drain;
 Pad no. 2, 4, 6 are Source;
 Pad no. 7 is Substrate.*

*Substrate pin should be connected to Source

RECOMMENDED LAND PATTERN

(measurements in μm)



The land pattern is solder mask defined.

Pad no. 1 is Gate

Pad no. 3, 5 are Drain

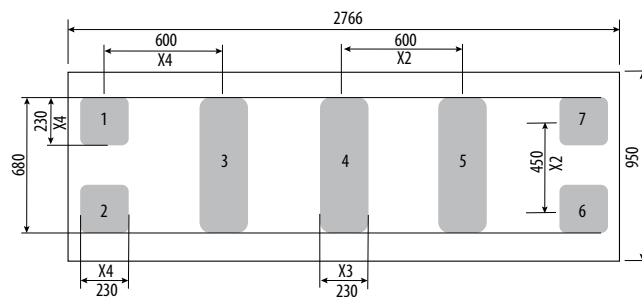
Pad no. 2, 4, 6 are Source

Pad no. 7 is Substrate*

*Substrate pin should be connected to Source

RECOMMENDED STENCIL DRAWING

(units in μm)



Recommended stencil should be 4 mil (100 μm) thick, must be laser cut, opening per drawing. The corner has a radius of R60.

Intended for use with SAC305 Type 4 solder, reference 88.5% metals content

Additional Resources Available

- Assembly resources available at: <https://epc-co.com/epc/DesignSupport/AssemblyBasics.aspx>
- Library of Altium footprints for production FETs and ICs: <https://epc-co.com/epc/documents/altium-files/EPC%20Altium%20Library.zip>
(for preliminary device Altium footprints, contact EPC)

Note: This datasheet is representative of lots with date code of 2131 or later.

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