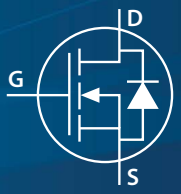
EPC2050 – Enhancement Mode Power Transistor

V_{DS}, 350 V
$R_{DS(on)}$, 80 mΩ max
I_D, 6.3 A



EFFICIENT POWER CONVERSION

RoHS Halogen-Free

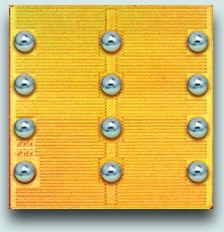
Gallium Nitride's exceptionally high electron mobility and low temperature coefficient allows very low $R_{DS(on)}$, while its lateral device structure and majority carrier diode provide exceptionally low Q_G and zero Q_{RR}. The end result is a device that can handle tasks where very high switching frequency, and low on-time are beneficial as well as those where on-state losses dominate.

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)	350	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	420	
I_D	Continuous (T_A = 25°C)	6.3	A
	Pulsed (25°C, T_{PULSE} = 300 µs)	26	
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 (Case TOP)	1.1	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board (Case BOTTOM)	10	
$R_{\theta JA\_JEDEC}$	Thermal Resistance, Junction-to-Ambient (using JEDEC 51-2 PCB)	65	
$R_{\theta JA\_EVB}$	Thermal Resistance, Junction-to-Ambient (using EPC99012 EVB)	45	



EPC2050 eGaN® FETs are supplied only in passivated die form with solder bumps

Die size:
1.95 x 1.95 mm

Applications

- High Voltage DC-DC Converter
- SMPS & UPS
- Solar Power Inverters and BMC
- Battery Management Systems
- DC-AC Inverters
- Class D Audio
- Lidar
- Medical Imaging
- RF Frequency Switch
- Consumer & Industrial Wiring
- Multi-Level AC-DC Conversion
- EV Charging
- Motor Drives
- Wireless Power Class-E Amplifiers
- LED Lighting

Benefits

- 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 = 0.08 mA	350			V
I_{DSS}	Drain-Source Leakage	V_{DS} = 280 V, V_{GS} = 0 V		0.001	0.06	mA
I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.001	0.5	
	Gate-to-Source Forward Leakage#	V_{GS} = 5 V, T_J = 125°C		0.03	1	
	Gate-to-Source Reverse Leakage	V_{GS} = -4 V		0.0005	0.1	
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 1 mA	0.7	1.3	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 6 A		55	80	mΩ
V_{SD}	Source-Drain Forward Voltage#	I_S = 0.5 A, V_{GS} = 0 V		1.5		V

Defined by design. Not subject to production test.

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} = 280 V		423	628	pF
C_{RSS}	Reverse Transfer Capacitance			0.3		
C_{OSS}	Output Capacitance			81	122	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 1)	V_{GS} = 0 V, V_{DS} = 0 to 280 V		101		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 2)			125		
R_G	Gate Resistance			0.5		Ω
Q_G	Total Gate Charge	V_{GS} = 5 V, V_{DS} = 280 V, I_D = 6 A		2.9	4	nC
Q_{GS}	Gate-to-Source Charge	V_{DS} = 280 V, I_D = 6 A		1.3		
Q_{GD}	Gate-to-Drain Charge			0.3		
$Q_{G(TH)}$	Gate Charge at Threshold			0.9		
Q_{OSS}	Output Charge	V_{GS} = 0 V, V_{DS} = 280 V		35	53	
Q_{RR}	Source-Drain Recovery Charge			0		

Defined by design. Not subject to production test.
Note 1: $C_{OSS(ER)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 80% BV_{DSS}.
Note 2: $C_{OSS(TR)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 80% BV_{DSS}.

Figure 1: Typical Output Characteristics at 25°C

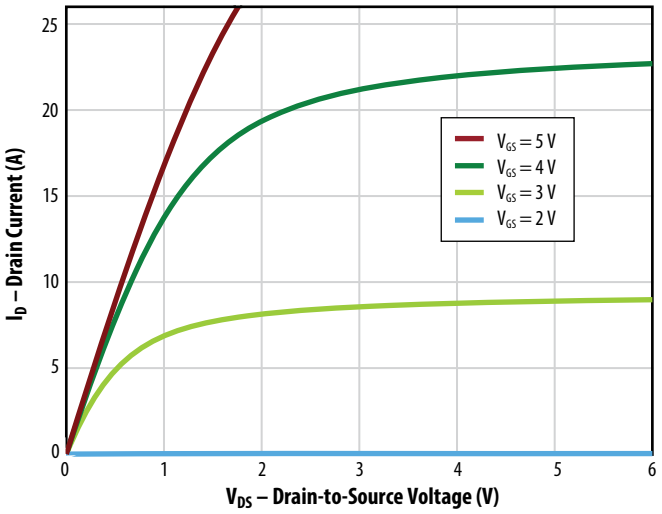


Figure 2: Transfer Characteristics

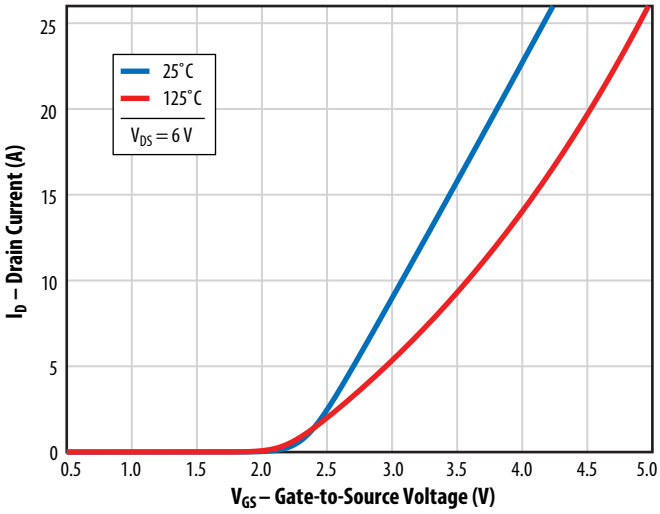


Figure 3: $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

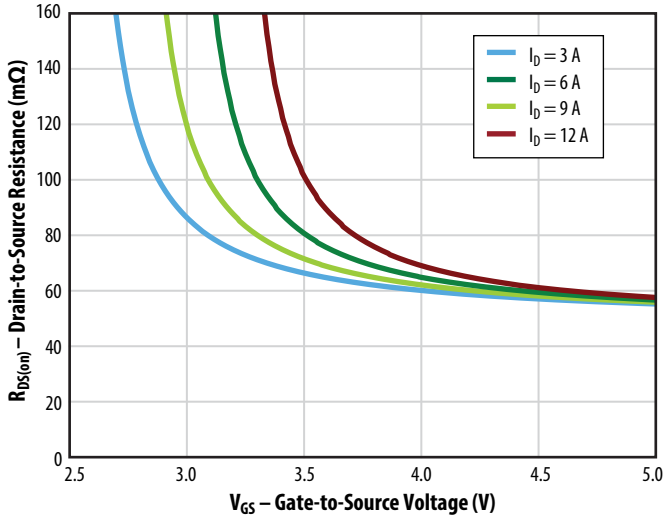


Figure 4: $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

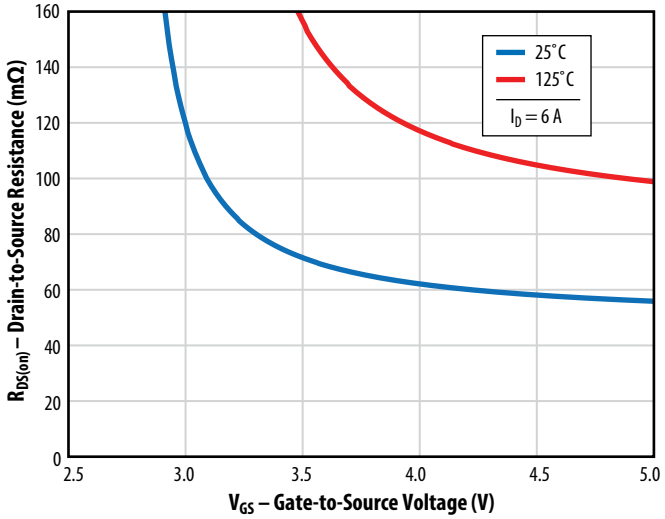


Figure 5a: Typical Capacitance (Linear Scale)

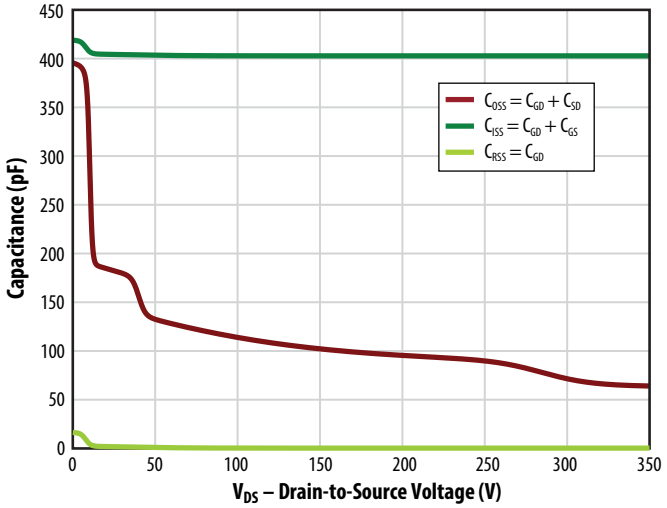


Figure 5b: Typical Capacitance (Log Scale)

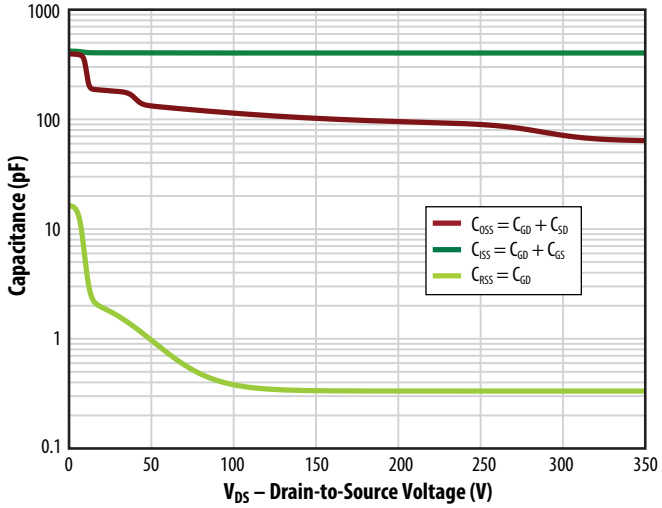


Figure 6: Typical Output Charge and C_{OSS} Stored Energy

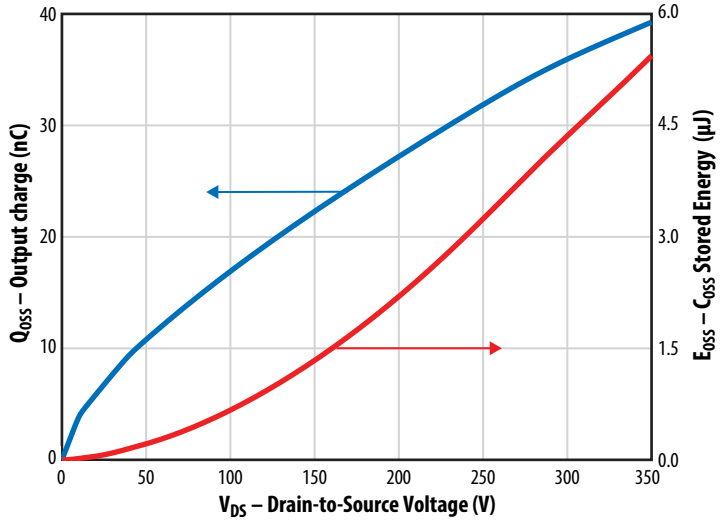


Figure 7: Typical Gate Charge

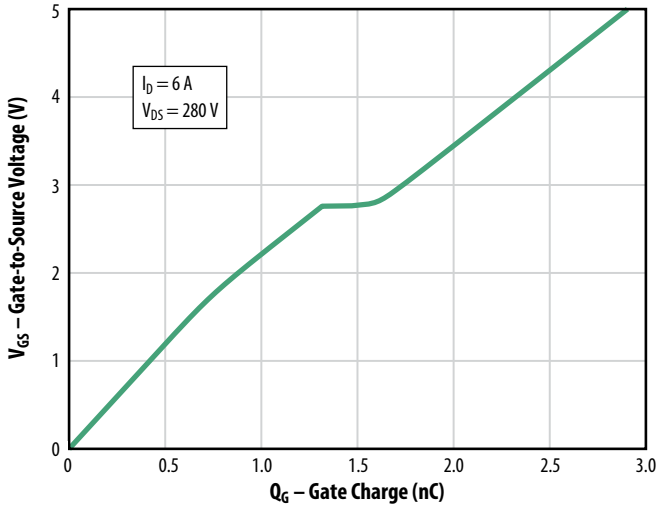


Figure 8: Reverse Drain-Source Characteristics

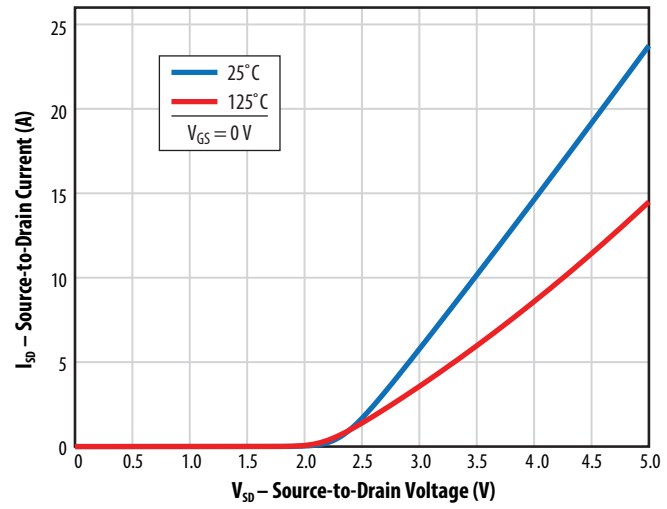
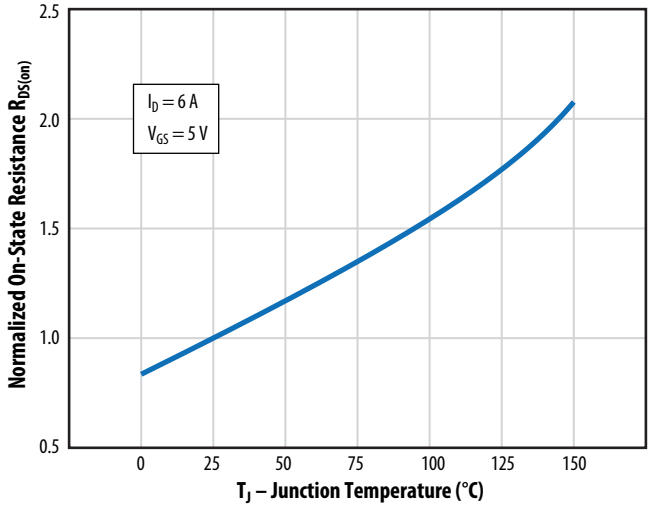


Figure 9: Normalized On-State Resistance vs. Temperature



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

All measurements were done with substrate shorted to source.

Figure 10: Normalized Threshold Voltage vs. Temperature

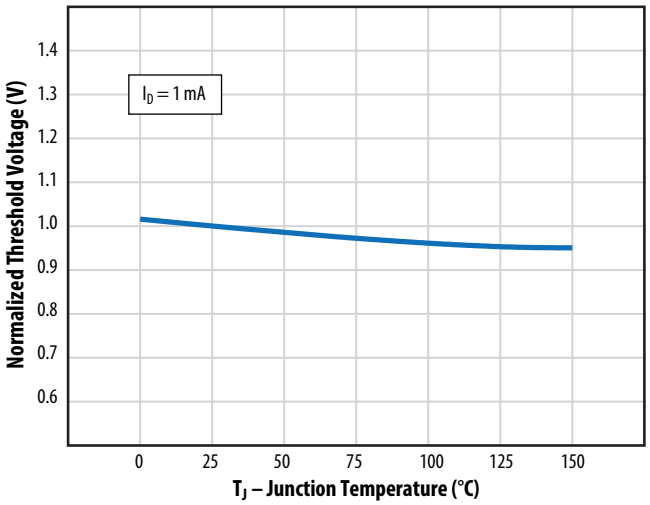
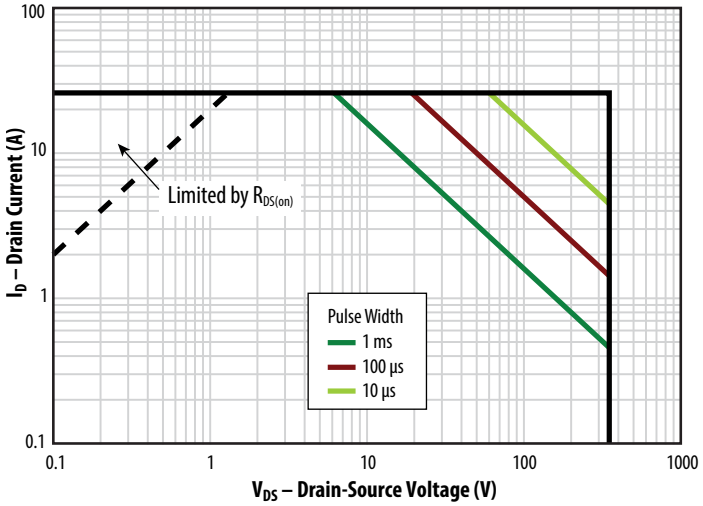


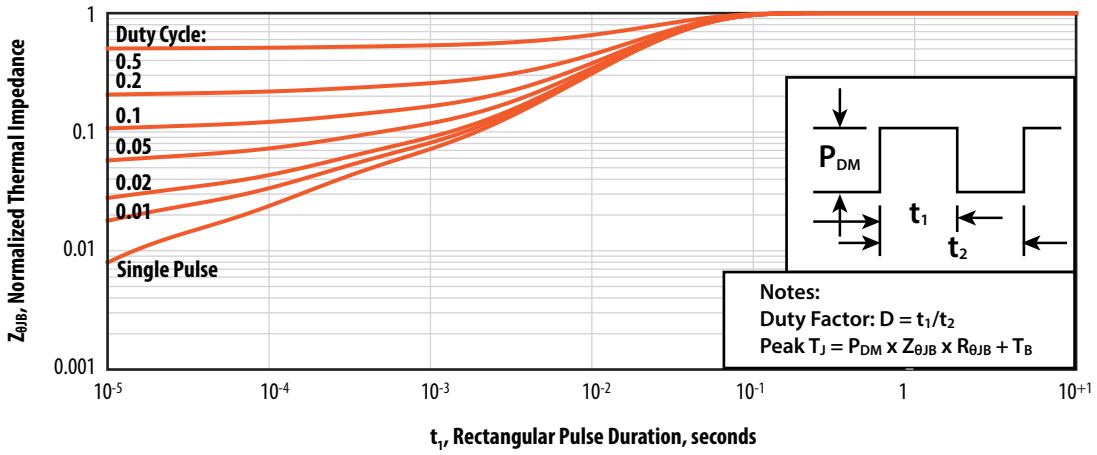
Figure 11: Safe Operating Area



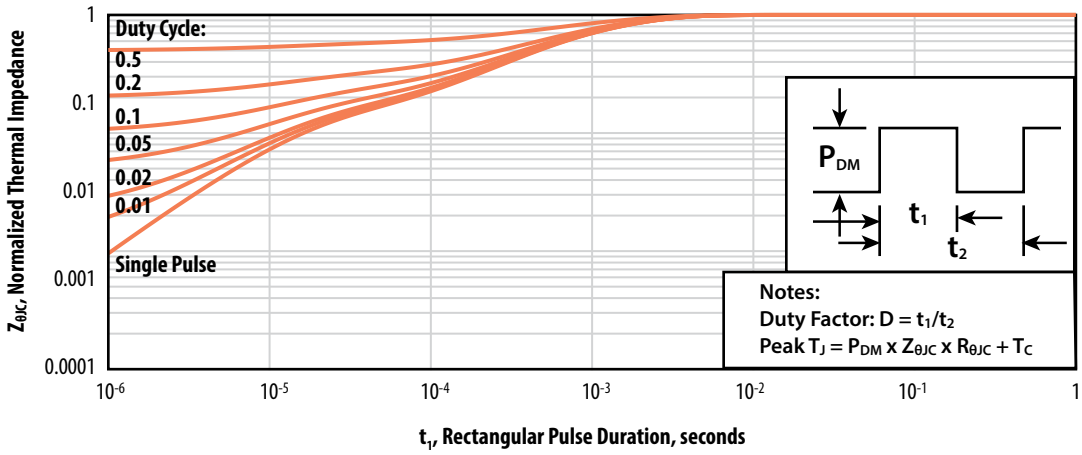
T_J = Max Rated, T_C = +25°C, Single Pulse

Figure 12: Transient Thermal Response Curves

Junction-to-Board

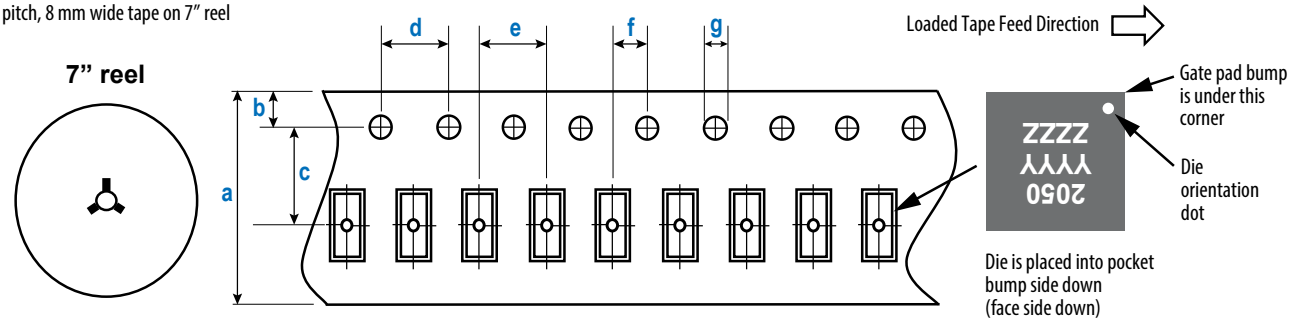


Junction-to-Case



TAPE AND REEL CONFIGURATION

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

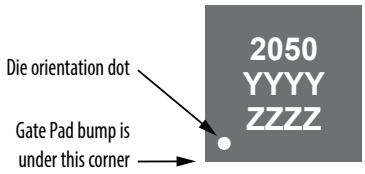


	Dimension (mm)		
EPC2050 (Note 1)	Target	MIN	MAX
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (Note 2)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (Note 2)	2.00	1.95	2.05
g	1.50	1.50	1.60

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.

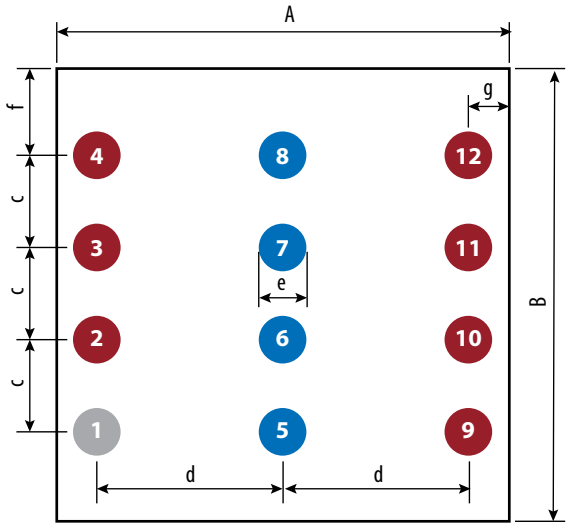
DIE MARKINGS



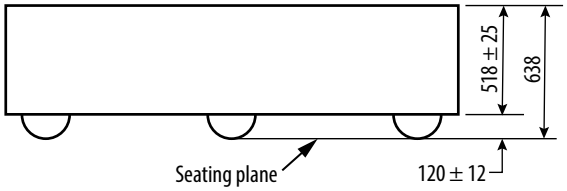
Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2050	2050	YYYY	ZZZZ

DIE OUTLINE

Solder Bar View



Side View



DIM	MICROMETERS		
	MIN	Nominal	MAX
A	1920	1950	1980
B	1920	1950	1980
c	400	400	400
d	800	800	800
e	180	200	220
f	360	375	390
g	160	175	190

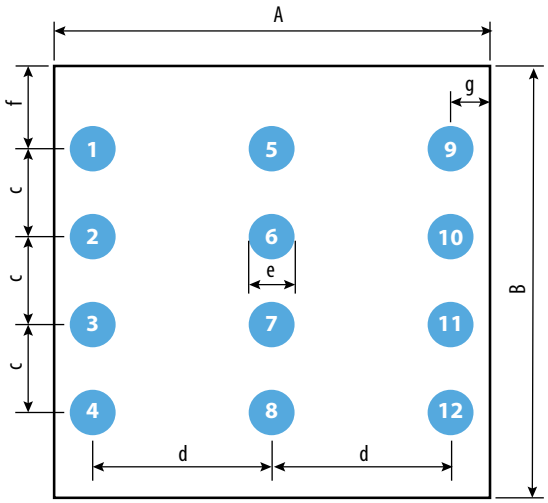
Pad 1 is Gate;

Pads 2, 3, 4, 9, 10, 11, 12 are Source;

Pads 5, 6, 7, 8 are Drain

RECOMMENDED LAND PATTERN

(measurements in µm)

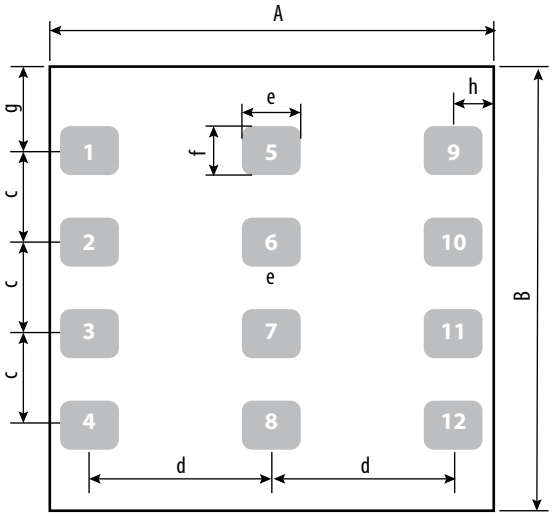


DIM	MICROMETERS
A	1950
B	1950
c	400
d	800
e	200
f	375
g	175

The land pattern is solder mask defined.

RECOMMENDED STENCIL DRAWING

(units in µm)



DIM	MICROMETERS
A	1950
B	1950
c	400
d	800
e	275
f	225
g	375
h	175

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 3 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)