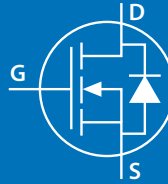


EPC2050 – Enhancement Mode Power Transistor

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

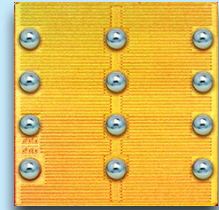
Revised April 4, 2022

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



Die Size: 1.95 x 1.95 mm

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

Applications

- High voltage DC-DC converter
- SMPS and UPS
- Solar power inverters and BMC
- Battery management systems
- DC-AC inverters
- Class D audio
- Lidar
- Medical imaging
- RF frequency switch
- Consumer and industrial wiring
- Multi-level AC-DC conversion
- EV charging
- Motor drives
- Wireless power Class-E amplifiers
- LED lighting

Benefits

- Ultra Small Footprint

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



<https://l.ead.me/EPC2050>

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 ($T_A = 25^\circ\text{C}$)	6.3	A
	Pulsed (25°C , $T_{PULSE} = 300 \mu\text{s}$)	26	
V_{GS}	Gate-to-Source Voltage	6	V
	Gate-to-Source Voltage	-4	
T_J	Operating Temperature	-40 to 150	$^\circ\text{C}$
T_{STG}	Storage Temperature	-40 to 150	

Thermal Characteristics			
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Case TOP)	1.1	$^\circ\text{C/W}$
$R_{\theta JB}$	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	

Static Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise stated)						
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-to-Source Voltage	$V_{GS} = 0 \text{ V}$, $I_D = 0.08 \text{ mA}$	350			V
I_{DSS}	Drain-Source Leakage	$V_{DS} = 280 \text{ V}$, $V_{GS} = 0 \text{ V}$		0.001	0.06	mA
I_{GSS}	Gate-to-Source Forward Leakage	$V_{GS} = 5 \text{ V}$		0.001	0.5	
	Gate-to-Source Forward Leakage [#]	$V_{GS} = 5 \text{ V}$, $T_J = 125^\circ\text{C}$		0.03	1	
	Gate-to-Source Reverse Leakage	$V_{GS} = -4 \text{ V}$		0.0005	0.1	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 1 \text{ mA}$	0.7	1.3	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5 \text{ V}$, $I_D = 6 \text{ A}$		55	80	mΩ
V_{SD}	Source-Drain Forward Voltage [#]	$I_S = 0.5 \text{ A}$, $V_{GS} = 0 \text{ V}$		1.5		V

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

Dynamic Characteristics[#] ($T_J = 25^\circ\text{C}$ unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 280\text{ V}$		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)	$V_{GS} = 0\text{ V}, V_{DS} = 0\text{ to }280\text{ V}$		101		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 2)			125		
R_G	Gate Resistance			0.5		Ω
Q_G	Total Gate Charge	$V_{GS} = 5\text{ V}, V_{DS} = 280\text{ V}, I_D = 6\text{ A}$		2.9	4	nC
Q_{GS}	Gate-to-Source Charge	$V_{DS} = 280\text{ V}, I_D = 6\text{ A}$		1.3		
Q_{GD}	Gate-to-Drain Charge			0.3		
$Q_{G(TH)}$	Gate Charge at Threshold			0.9		
Q_{OSS}	Output Charge	$V_{GS} = 0\text{ V}, V_{DS} = 280\text{ V}$		35	53	
Q_{RR}	Source-Drain Recovery Charge			0		

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

All measurements were done with substrate connected to source.

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} .

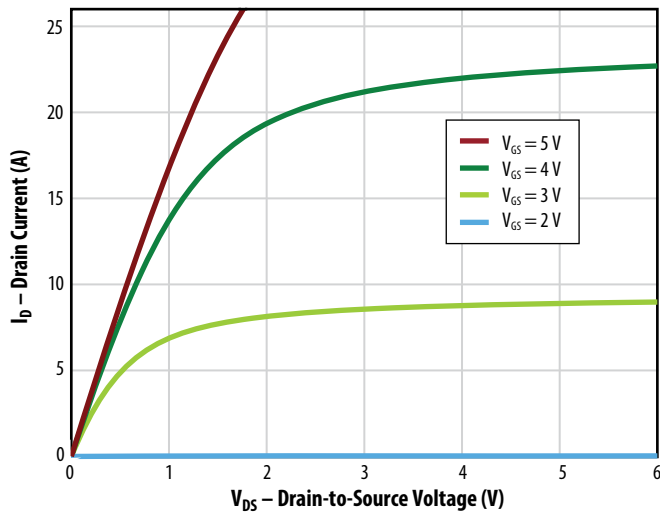
Figure 1: Typical Output Characteristics at 25°C 

Figure 2: Typical Transfer Characteristics

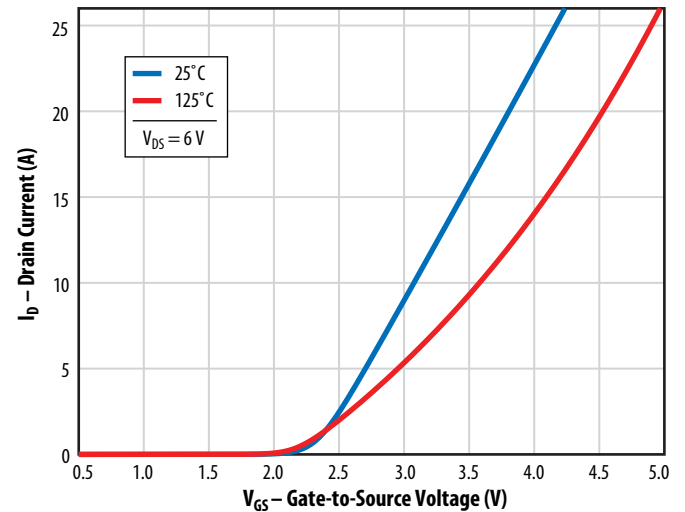
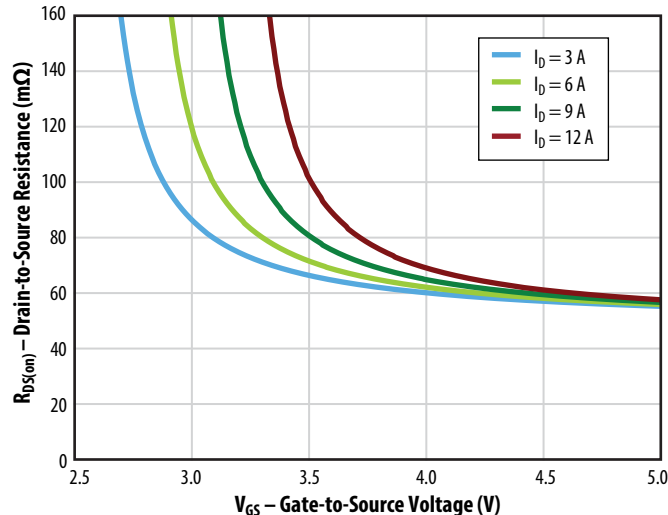
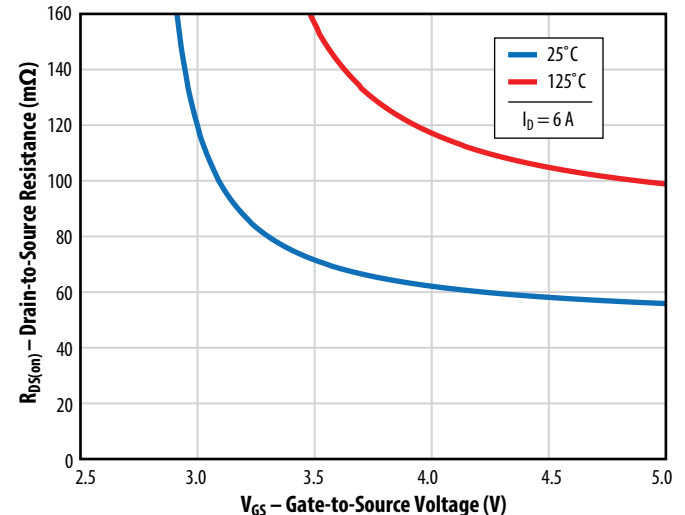
Figure 3: Typical $R_{DS(on)}$ vs. V_{GS} for Various Drain CurrentsFigure 4: Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

Figure 5a: Typical Capacitance (Linear Scale)

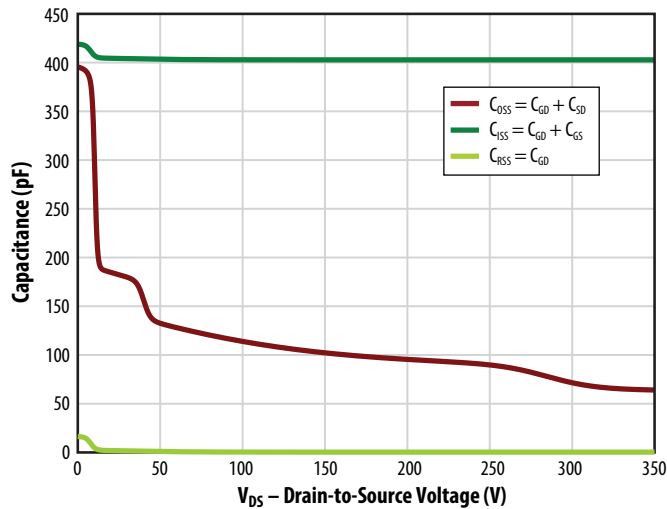


Figure 5b: Typical Capacitance (Log Scale)

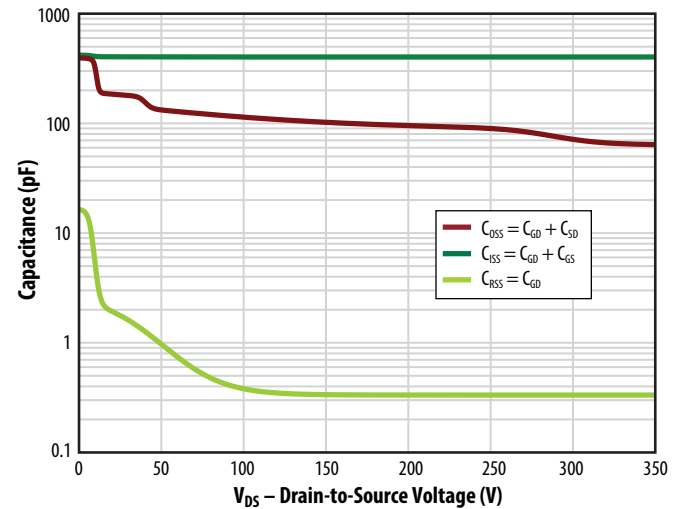
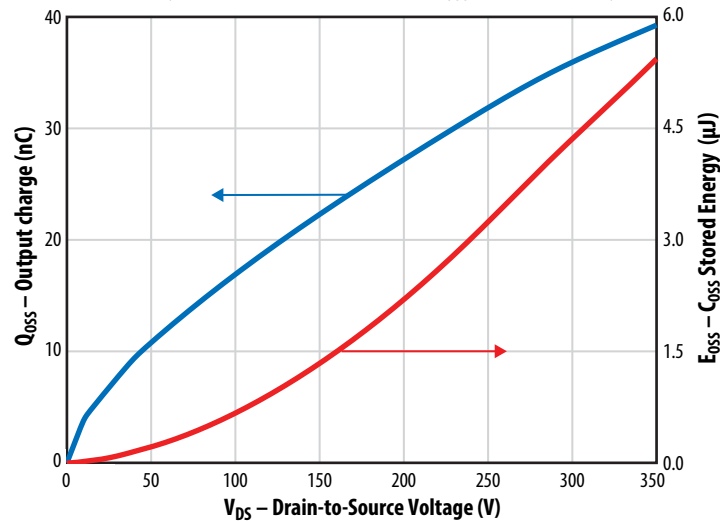
Figure 6: Typical Output Charge and C_{OSS} Stored Energy

Figure 7: Typical Gate Charge

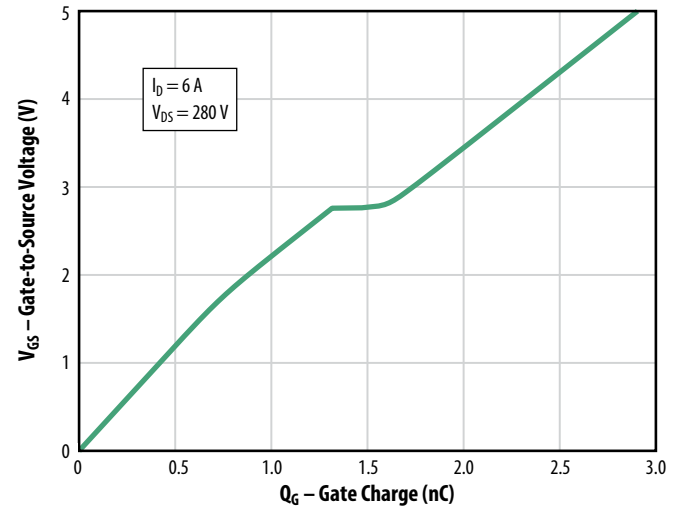


Figure 8: Typical Reverse Drain-Source Characteristics

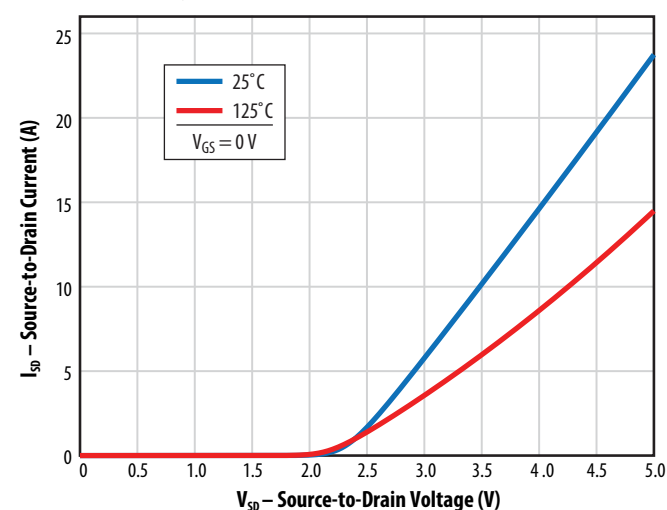
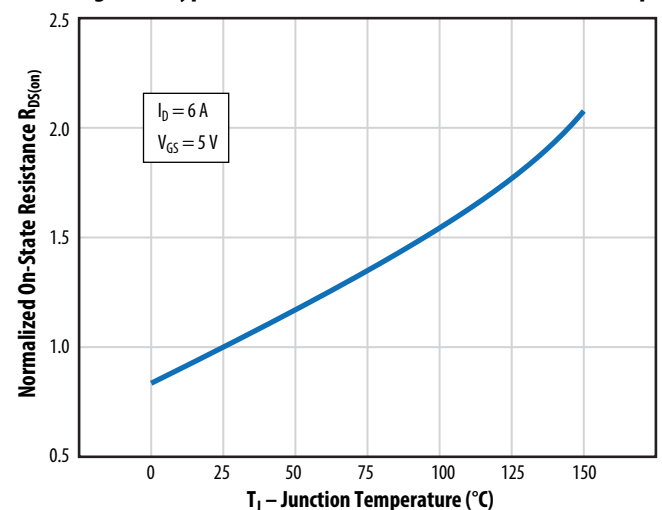


Figure 9: Typical Normalized On-State Resistance vs. Temp.



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

All measurements were done with substrate shorted to source.

Figure 10: Typical Normalized Threshold Voltage vs. Temp.

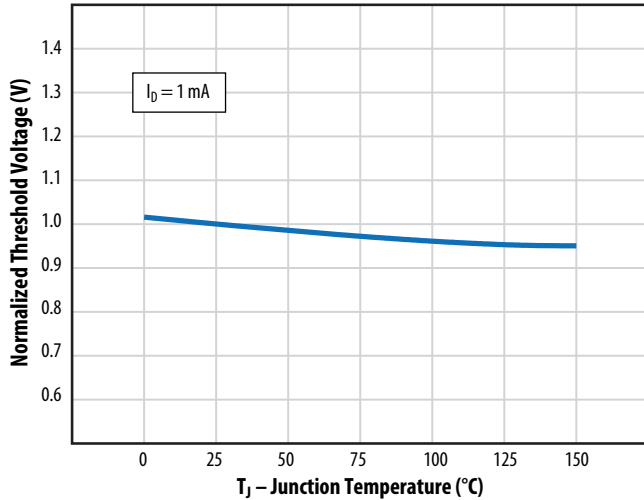


Figure 11: Safe Operating Area

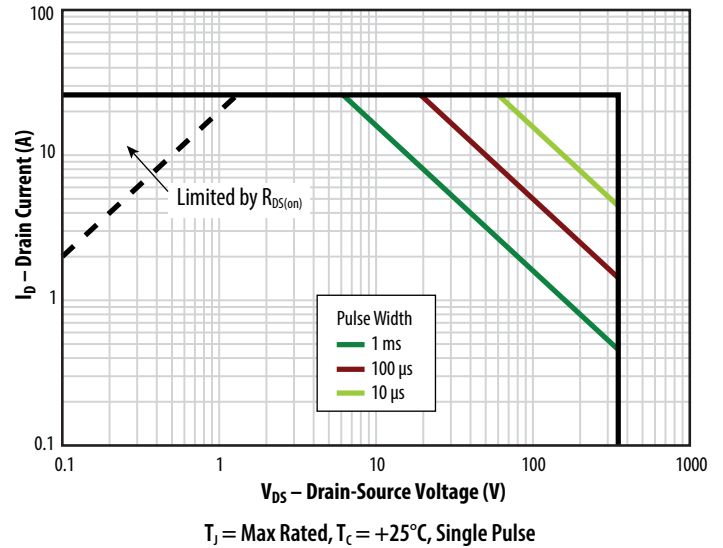
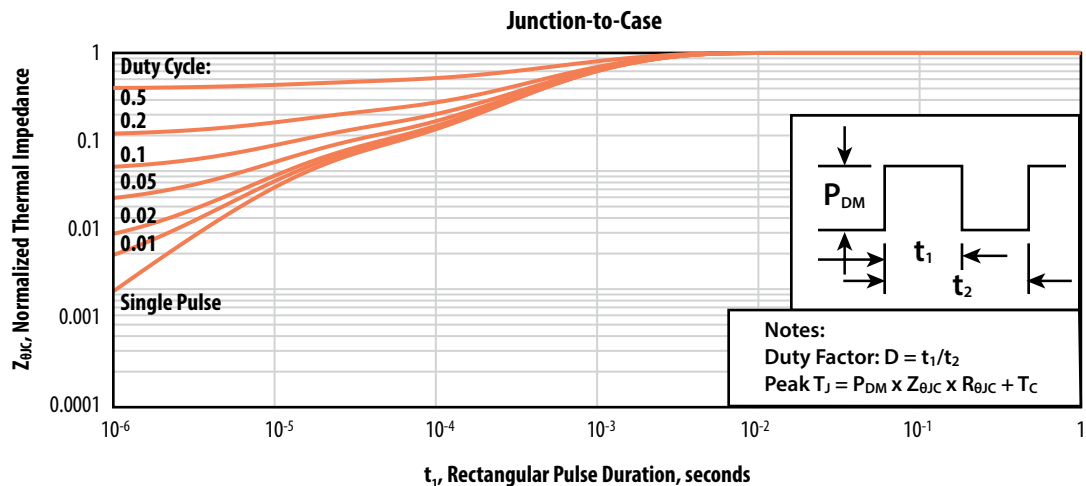
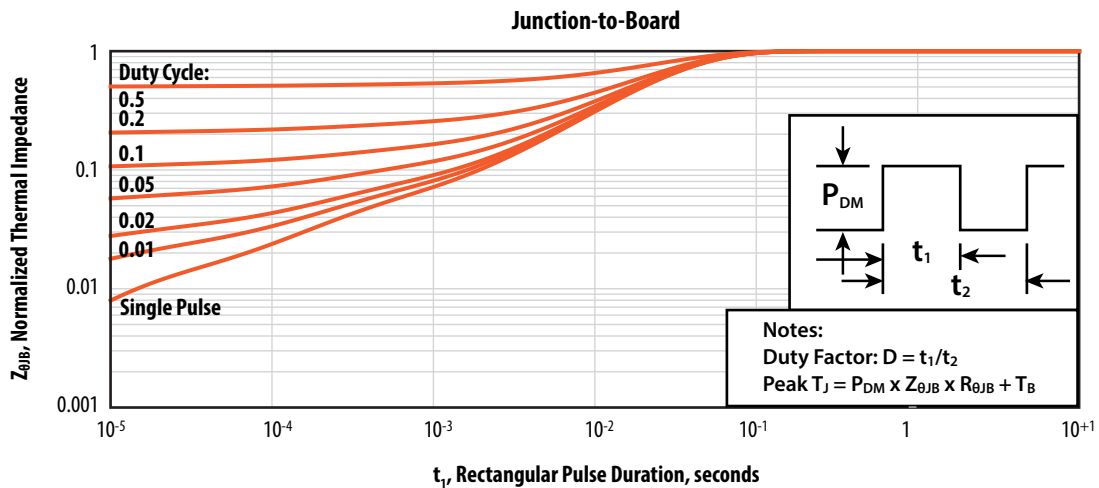
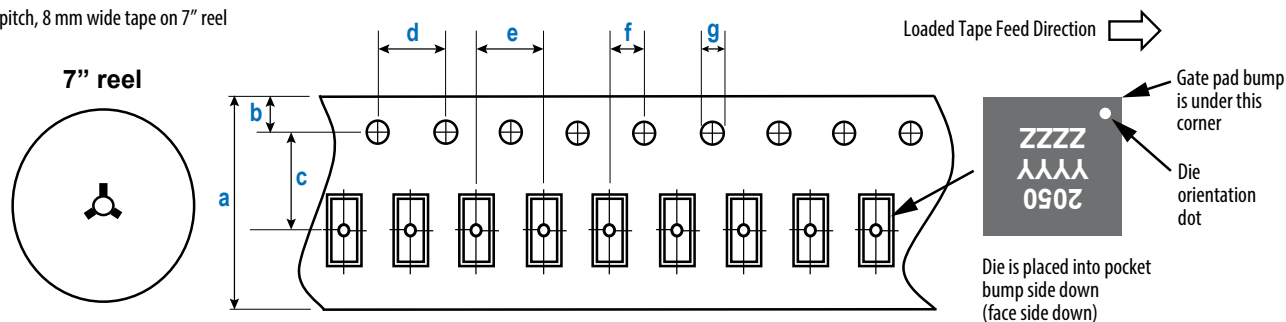


Figure 12: Typical Transient Thermal Response Curves



TAPE AND REEL CONFIGURATION

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

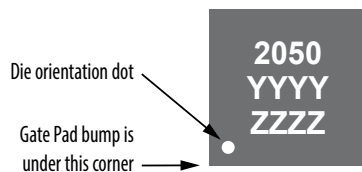


EPC2050 (Note 1)	Dimension (mm)		
	Target	MIN	MAX
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (Note 2)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (Note 2)	2.00	1.95	2.05
g	1.50	1.50	1.60

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.

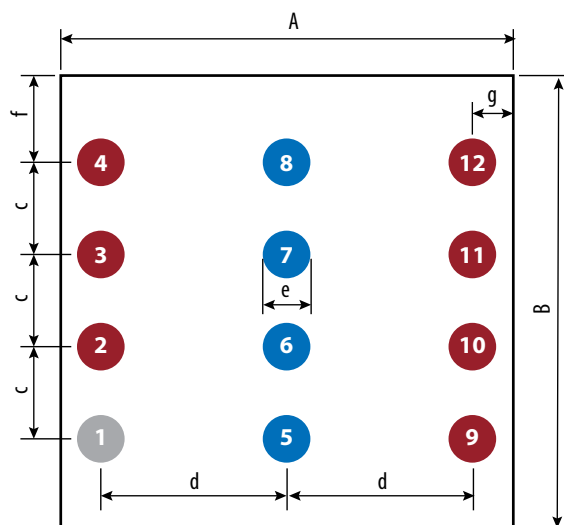
DIE MARKINGS



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

DIE OUTLINE

Solder Bar View



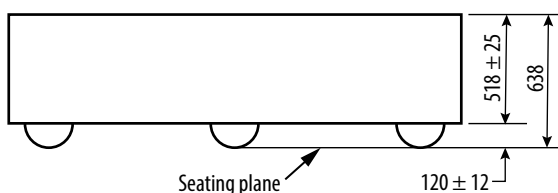
DIM	MICROMETERS		
	MIN	Nominal	MAX
A	1920	1950	1980
B	1920	1950	1980
c	400	400	400
d	800	800	800
e	180	200	220
f	360	375	390
g	160	175	190

Pad 1 is Gate;

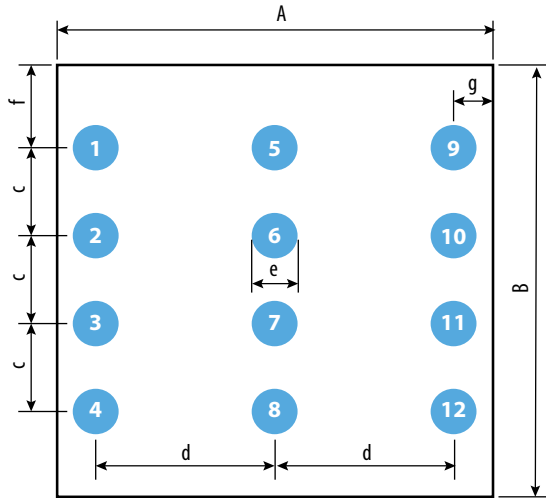
Pads 2, 3, 4, 9, 10, 11, 12 are Source;

Pads 5, 6, 7, 8 are Drain

Side View



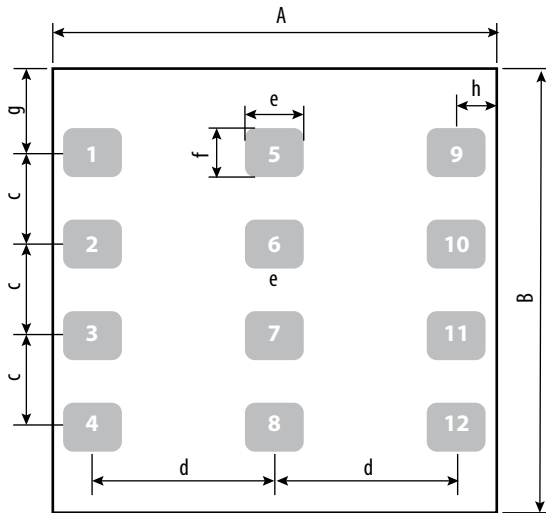
RECOMMENDED
LAND PATTERN
(measurements in μm)



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 4 solder, reference 88.5% metals content

Additional Resources Available

- Assembly resources available at: <https://epc-co.com/epc/design-support>
- 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)

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