EPC2107 – Enhancement-Mode GaN Power Transistor Half-Bridge with Integrated Synchronous Bootstrap

V_{DS} , 100 V
$R_{DS(on)}$, 390 mΩ
I_D , 1.7 A

EFFICIENT POWER CONVERSION

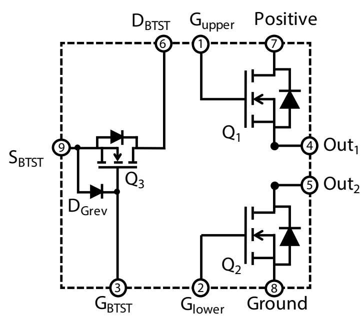
RoHS Halogen-Free

Revised May 19, 2020

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

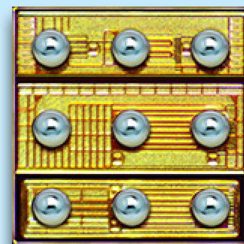
EPC2107 – Detailed Schematic



Maximum Ratings				
DEVICE		**PARAMETER**	**VALUE**	**UNIT**
Q1 & Q2	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˚C, $R_{θJA}$ = 60°C/W)	1.7	A
		Pulsed (25°C, T_{PULSE} = 300 µs)	3.8	
	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	
Q3	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˚C, $R_{θJA}$= 100°C/W)	0.5	A
		Pulsed (25°C, T_{PULSE} = 300 µs)	0.5	
	V_{GS}	Gate-to-Source Voltage	6	V
		Operating Temperature	–40 to 150	
	T_J	Storage Temperature	–40 to 150	°C
	T_{STG}	Storage Temperature	–40 to 150	

Thermal Characteristics			
	PARAMETER	**TYP**	**UNIT**
$R_{θJC}$	Thermal Resistance, Junction-to-Case	6	°C/W
$R_{θJB}$	Thermal Resistance, Junction-to-Board	33	
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	81	

Note 1: $R_{θJA}$ 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



Die size: 1.35 x 1.35 mm

EPC2107 eGaN® ICs are supplied only in passivated die form with solder bumps.

Applications

- High frequency DC-DC conversion
- Class-D audio
- Wireless power (highly resonant and inductive)

Benefits

- Ultra high efficiency
- Ultra low $R_{DS(on)}$
- 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/EPC2107

Static Characteristics (T_J = 25˚C unless otherwise stated)							
DEVICE	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Q1 & Q2	BV_{DSS}	Drain-to-Source Voltage	V_{GS} = 0 V, I_D = 0.3 mA	100			V
	I_{DSS}	Drain-Source Leakage	V_{GS} = 0 V, V_{DS} = 80 V		0.05	0.25	mA
	I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.1	1	mA
		Gate-to-Source Reverse Leakage	V_{GS} = -4 V		0.05	0.25	mA
	$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.1 mA	0.8	1.6	2.5	V
	$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 2 A		250	390	mΩ
	V_{SD}	Source-Drain Forward Voltage	V_{GS} = 0 V, I_S = 0.5 A		2.5		V
Q3	BV_{DSS}	Drain-to-Source Voltage	V_{GS} = 0 V, I_D = 0.125 mA	100			V
	I_{DSS}	Drain-Source Leakage	V_{GS} = 0 V, V_{DS} = 80 V		0.02	0.1	mA
	I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.1	1	mA
	V_F	Source-Gate Forward Voltage	I_F = 0.2 mA, V_{DS} = 0 V			2.7	V
	$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.1 mA	0.8	1.7	2.5	V
	$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 0.05 A		2100	3300	mΩ
	V_{SD}	Source-Drain Forward Voltage	V_{GS} = 0 V, I_S = 0.1 A		2.9		V

Dynamic Characteristics (T_J = 25˚C unless otherwise stated)							
DEVICE	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Q1	C_{ISS}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 50 V		21	25	pF
	C_{RSS}	Reverse Transfer Capacitance			0.2		
	C_{OSS}	Output Capacitance			9.2	14	
	$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{GS} = 0 V, V_{DS} = 0 to 50 V		13		
	$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			18		
	R_G	Gate Resistance			0.7		Ω
	Q_G	Total Gate Charge	V_{GS} = 5 V, V_{DS} = 50 V, I_D = 2 A		190	230	pC
	Q_{GS}	Gate to Source Charge	V_{DS} = 50 V, I_D = 2 A		77		
	Q_{GD}	Gate to Drain Charge			41		
	$Q_{G(TH)}$	Gate Charge at Threshold			49		
	Q_{OSS}	Output Charge	V_{GS} = 0 V, V_{DS} = 50 V		900	1350	
	Q_{RR}	Source-Drain Recovery Charge			0		
Q2	C_{ISS}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 50 V		21	25	pF
	C_{RSS}	Reverse Transfer Capacitance			0.2		
	C_{OSS}	Output Capacitance			14	21	
	$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{GS} = 0 V, V_{DS} = 0 to 50 V		19		
	$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			25		
	R_G	Gate Resistance			0.7		Ω
	Q_G	Total Gate Charge	V_{GS} = 5 V, V_{DS} = 50 V, I_D = 2 A		190	230	pC
	Q_{GS}	Gate to Source Charge	V_{DS} = 50 V, I_D = 2 A		77		
	Q_{GD}	Gate to Drain Charge			41		
	$Q_{G(TH)}$	Gate Charge at Threshold			49		
	Q_{OSS}	Output Charge	V_{GS} = 0 V, V_{DS} = 50 V		1250	1875	
	Q_{RR}	Source-Drain Recovery Charge			0		
Q3	C_{ISS}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 50 V		7	8.4	pF
	C_{RSS}	Reverse Transfer Capacitance			0.02		
	C_{OSS}	Output Capacitance			1.6	2.4	
	$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{GS} = 0 V, V_{DS} = 0 to 50 V		2.2		
	$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			2.7		
	R_G	Gate Resistance			4.8		Ω
	Q_G	Total Gate Charge	V_{GS} = 5 V, V_{DS} = 50 V, I_D = 0.05 A		44	55	pC
	Q_{GS}	Gate to Source Charge	V_{DS} = 50 V, I_D = 0.05 A		20		
	Q_{GD}	Gate to Drain Charge			4		
	$Q_{G(TH)}$	Gate Charge at Threshold			18		
	Q_{OSS}	Output Charge	V_{GS} = 0 V, V_{DS} = 50 V		134	200	
	Q_{RR}	Source-Drain Recovery Charge			0		

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: $C_{OSS(ER)}$ 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 1a (Q1 & Q2): Typical Output Characteristics at 25°C

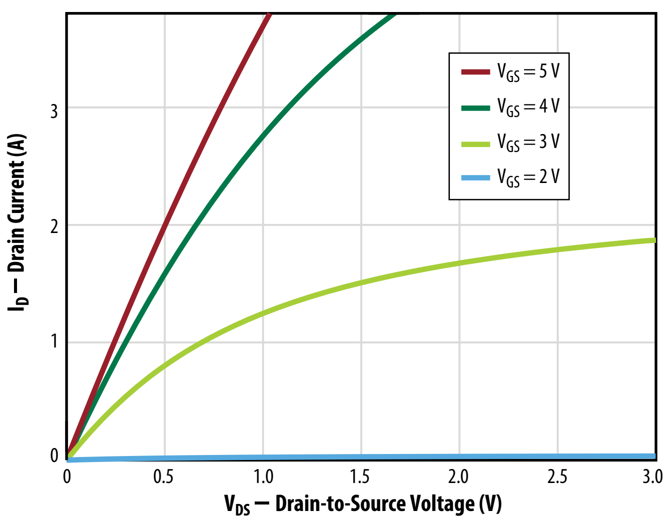


Figure 1b (Q3): Typical Output Characteristics at 25°C

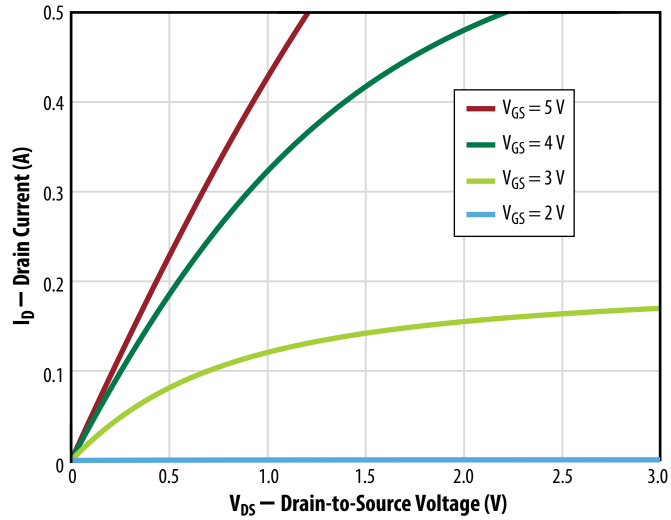


Figure 2a (Q1 & Q2): Typical Transfer Characteristics

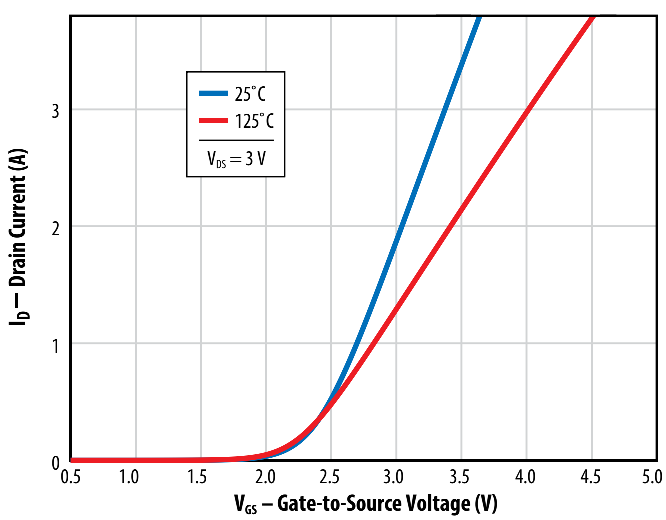


Figure 2b (Q3): Typical Transfer Characteristics

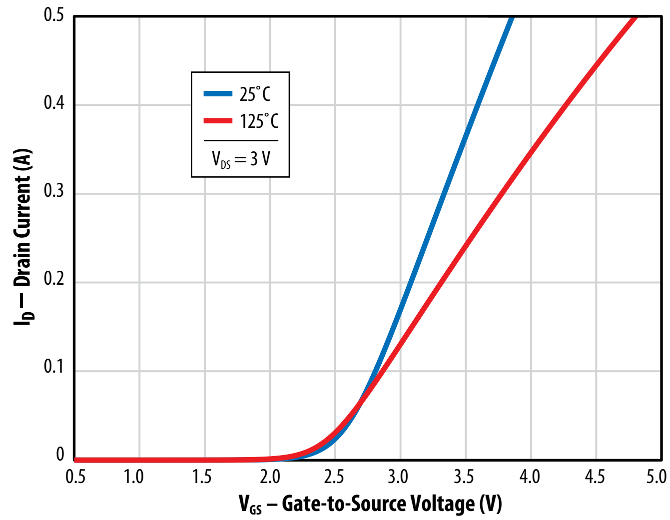


Figure 3a (Q1 & Q2):
Typical $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

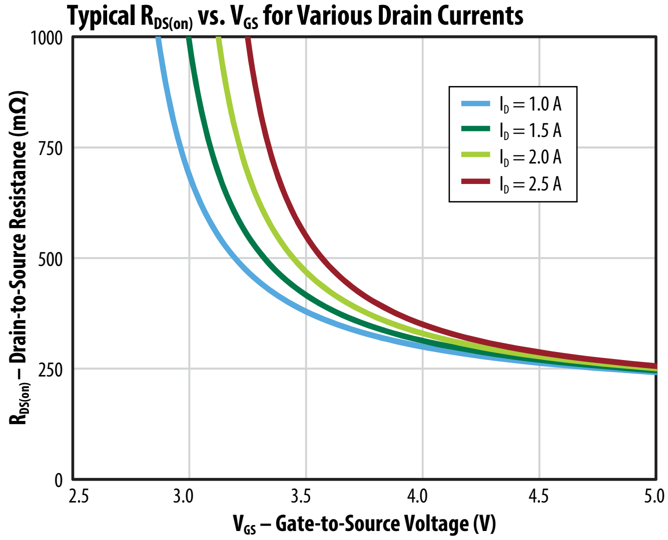


Figure 3b (Q3):
Typical $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

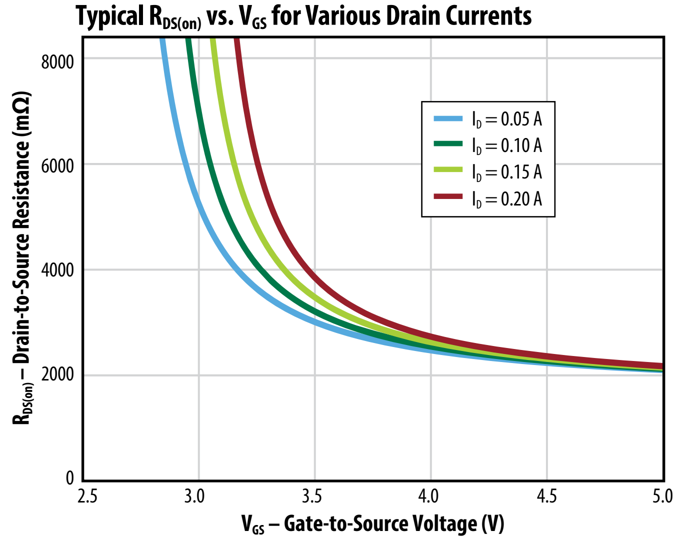


Figure 4a (Q1 & Q2): Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

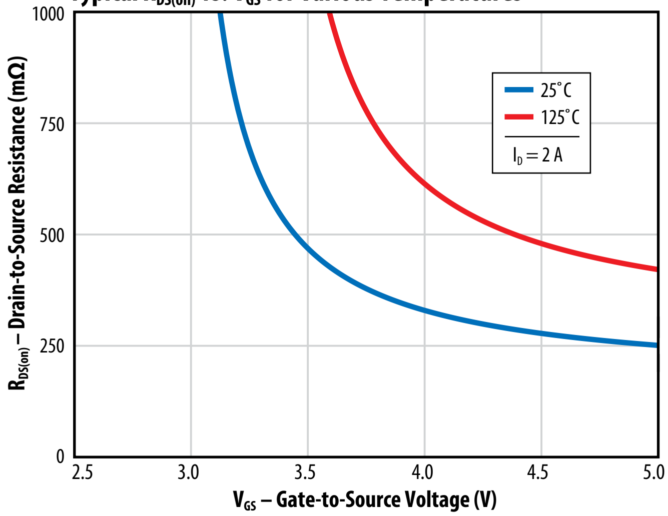


Figure 4b (Q3): Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

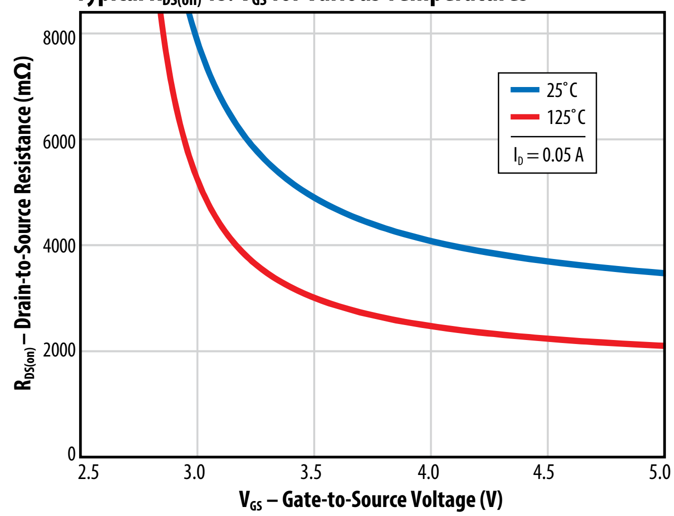


Figure 5a (Q1): Typical Capacitance (Linear Scale)

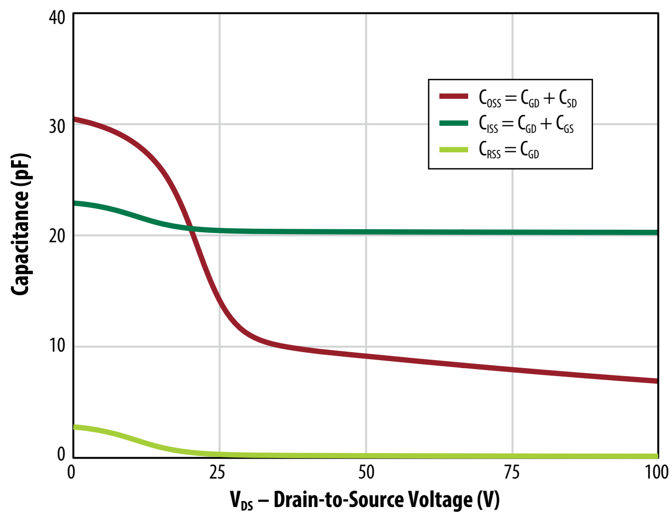


Figure 5b (Q1): Typical Capacitance (Log Scale)

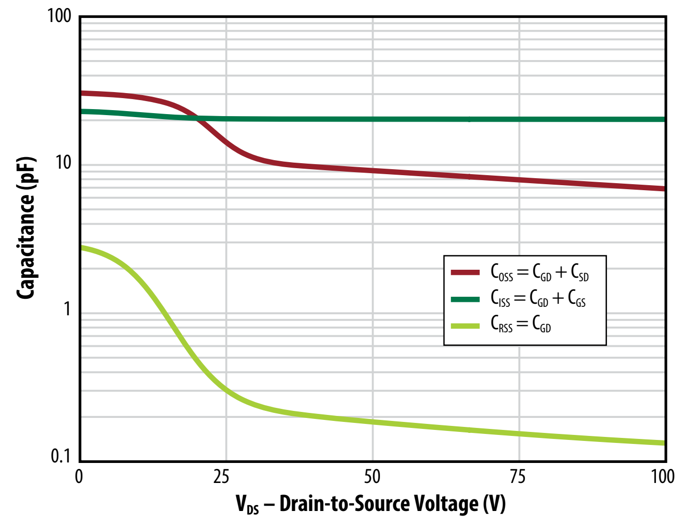


Figure 5c (Q2): Typical Capacitance (Linear Scale)

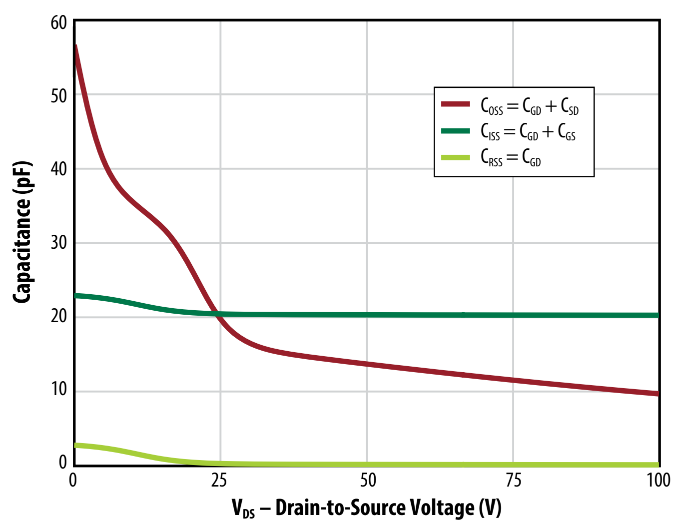


Figure 5d (Q2): Typical Capacitance (Log Scale)

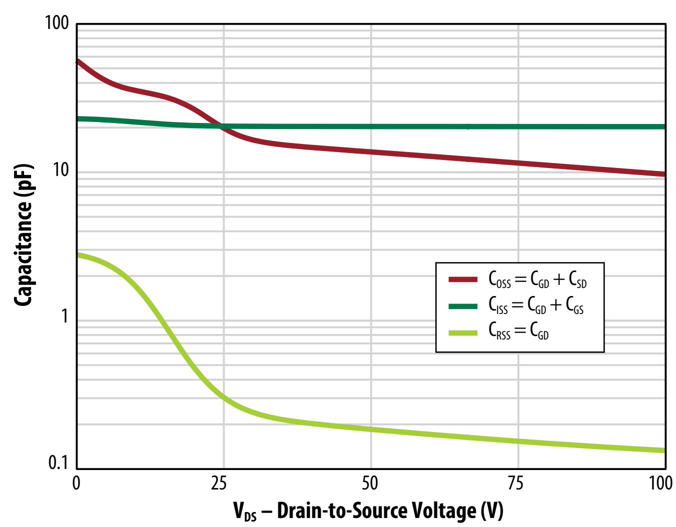


Figure 5e (Q3): Typical Capacitance (Linear Scale)

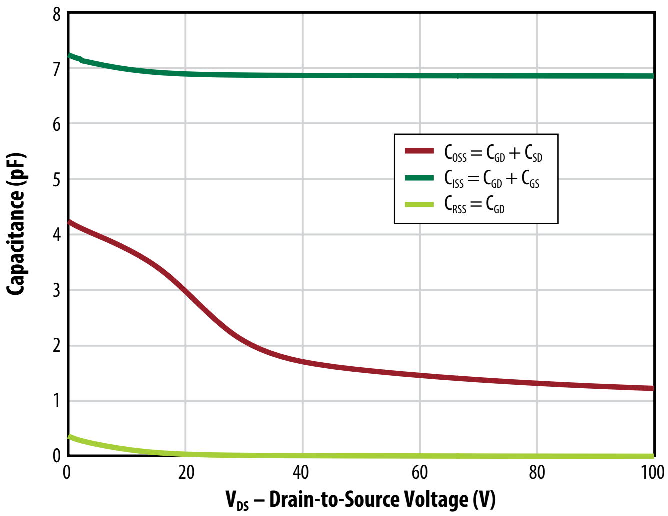


Figure 5f (Q3): Typical Capacitance (Log Scale)

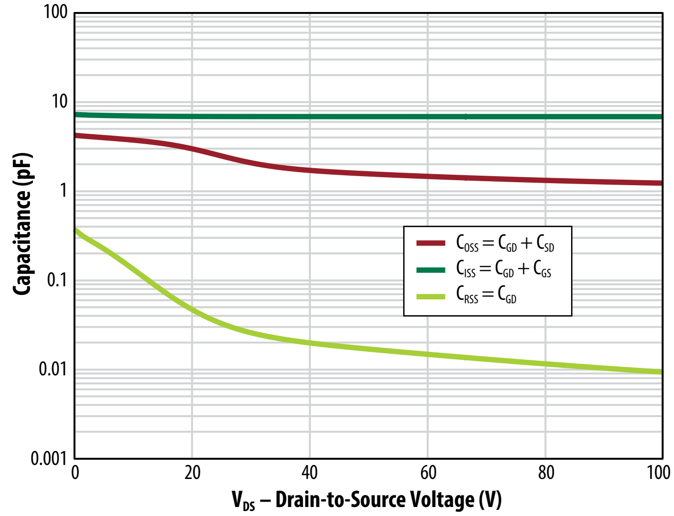


Figure 6a (Q1): Typical Output Charge and C_{OSS} Stored Energy

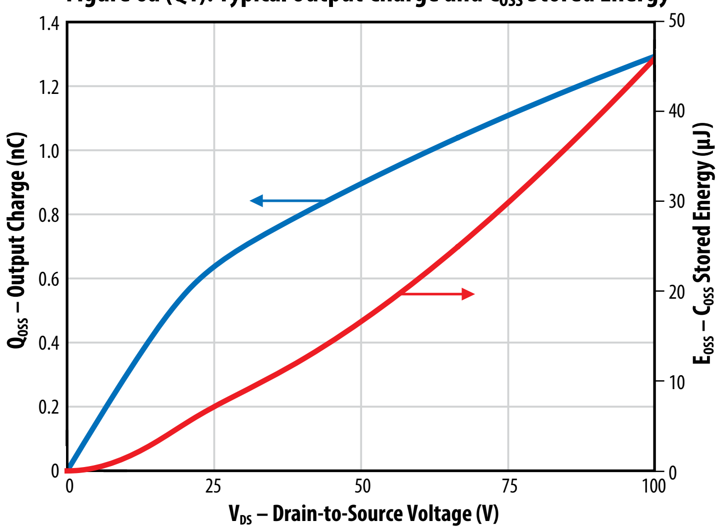


Figure 6b (Q2): Typical Output Charge and C_{OSS} Stored Energy

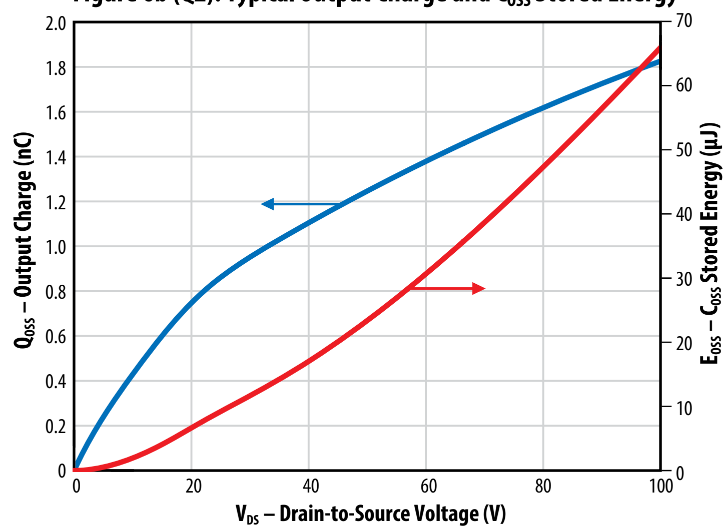


Figure 6c (Q3): Typical Output Charge and C_{OSS} Stored Energy

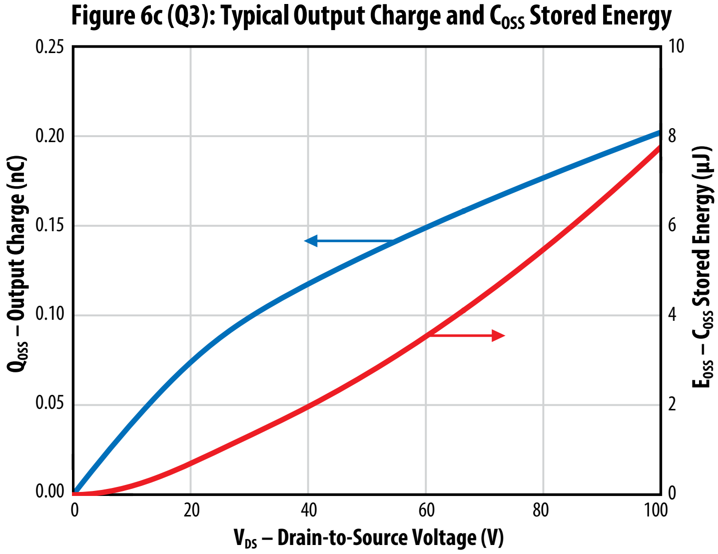


Figure 7a (Q1 & Q2): Typical Gate Charge

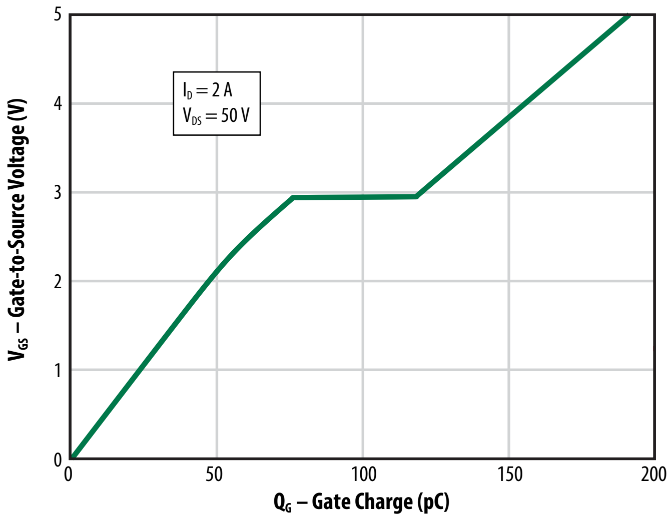


Figure 7b (Q3): Typical Gate Charge

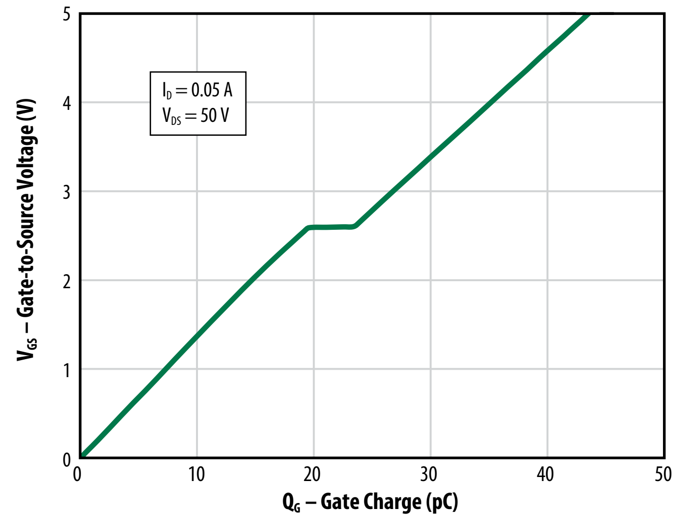
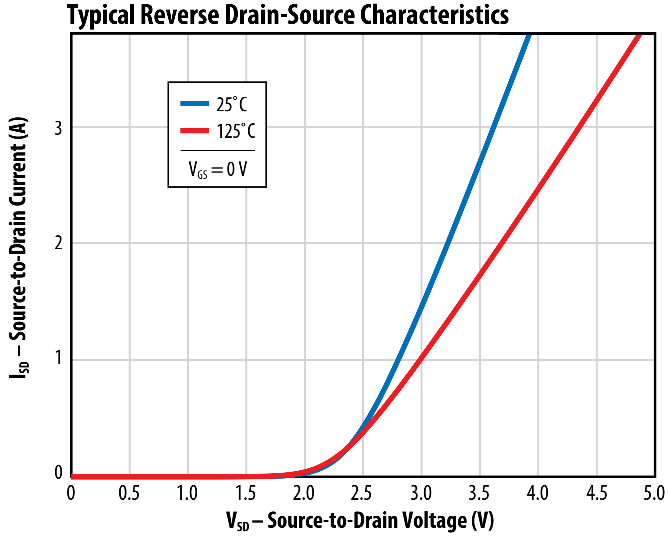
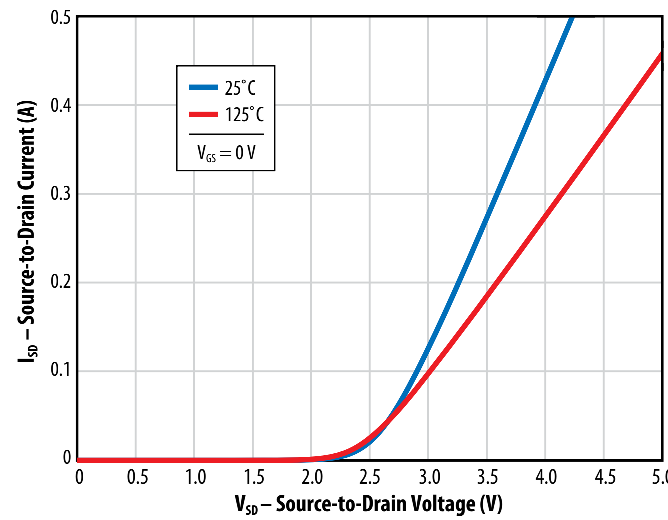


Figure 8a (Q1 & Q2):
Typical Reverse Drain-Source Characteristics



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

Figure 8b (Q3): Typical Reverse Drain-Source Characteristics



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

Figure 9a (Q1 & Q2):
Typical Normalized On-State Resistance vs. Temperature

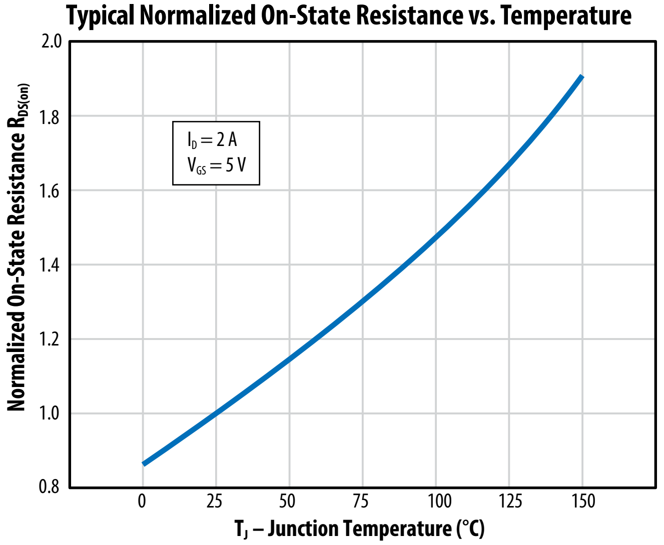


Figure 9b (Q3):
Typical Normalized On-State Resistance vs. Temperature

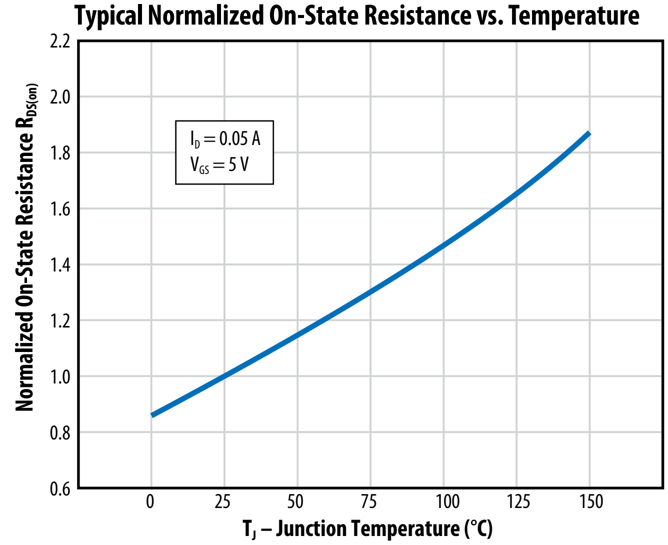


Figure 10a (Q1 & Q2):
Typical Normalized Threshold Voltage vs. Temperature

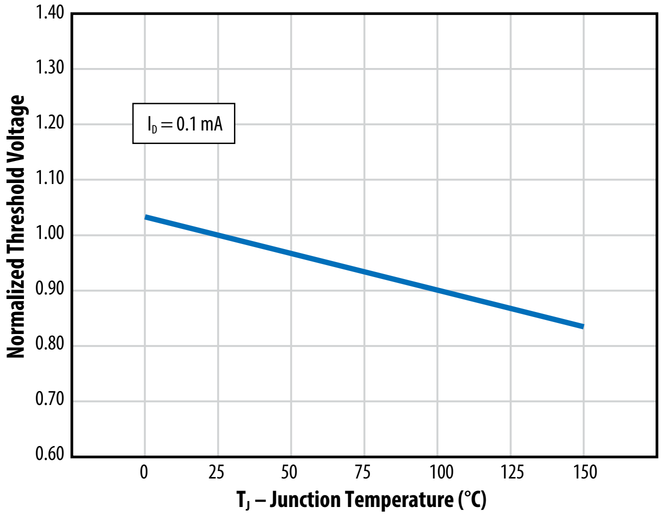


Figure 10b (Q3):
Typical Normalized Threshold Voltage vs. Temperature

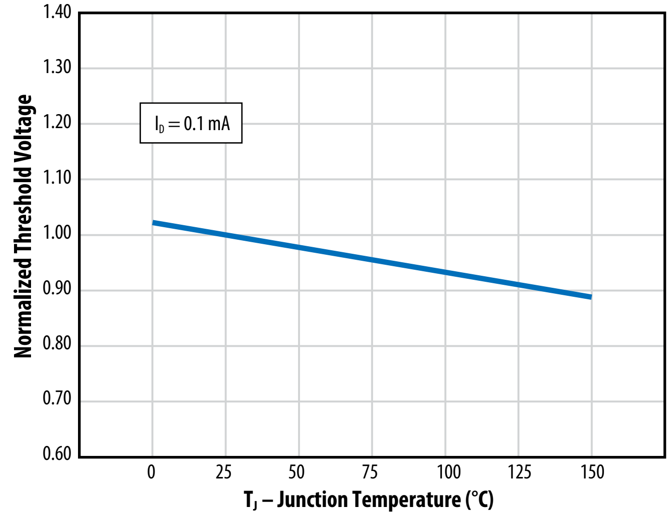


Figure 11a
Typical Transient Thermal Response Curves

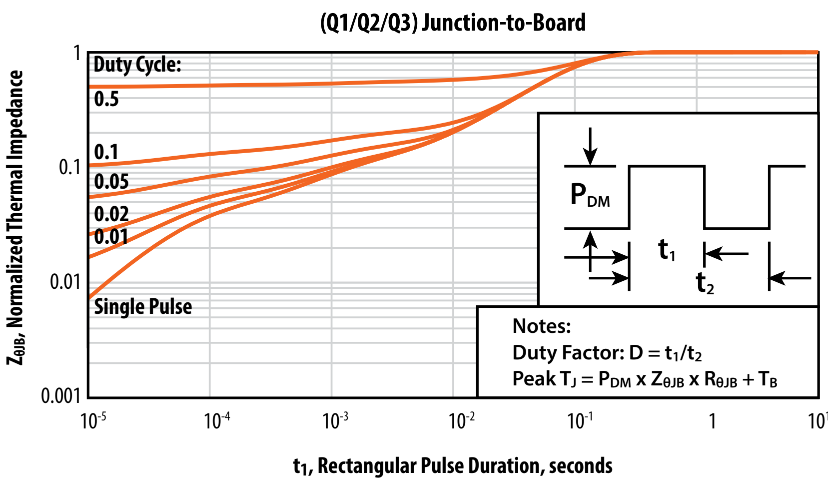


Figure 11b
Typical Transient Thermal Response Curves

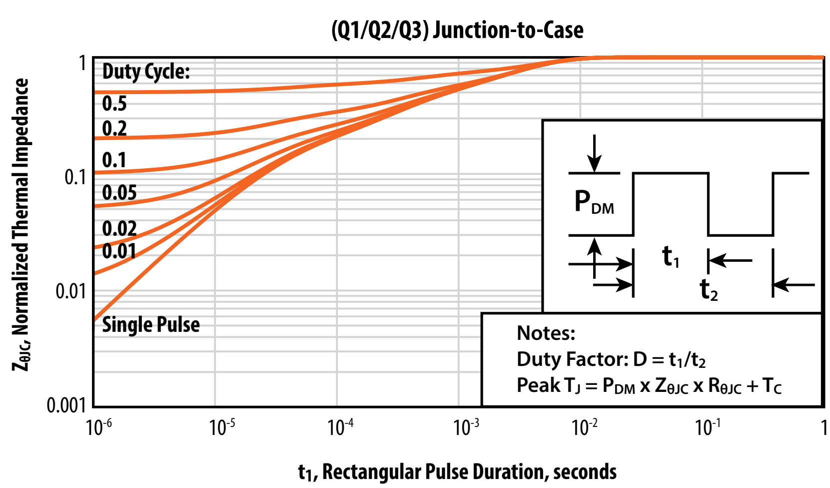


Figure 12 (Q1 & Q2): Safe Operating Area

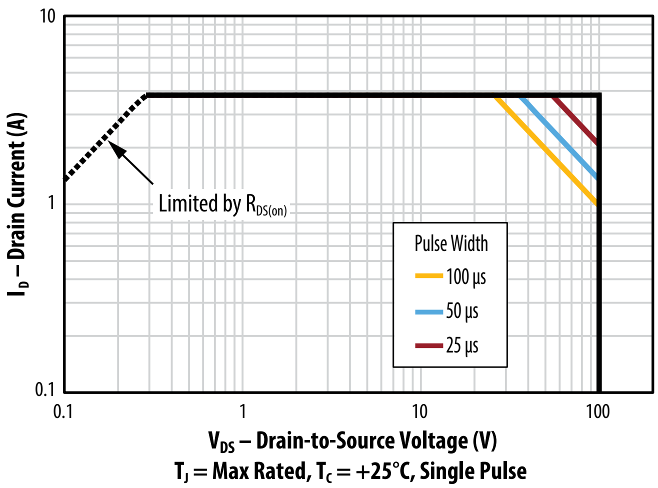


Figure 13 (Q3): Typical Gate-Source Characteristics

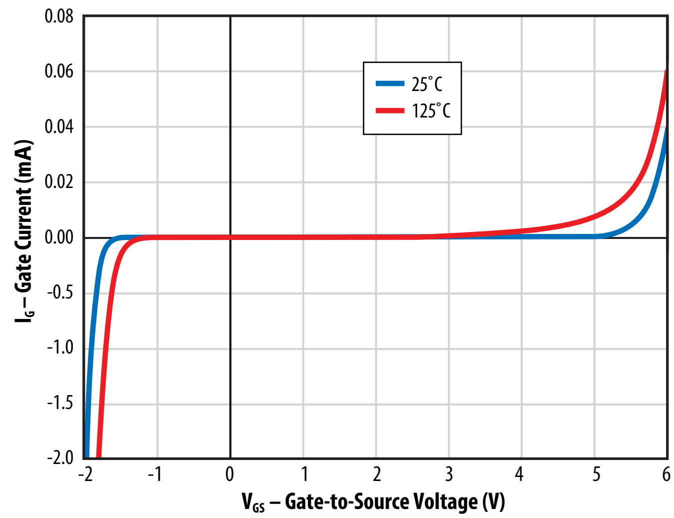
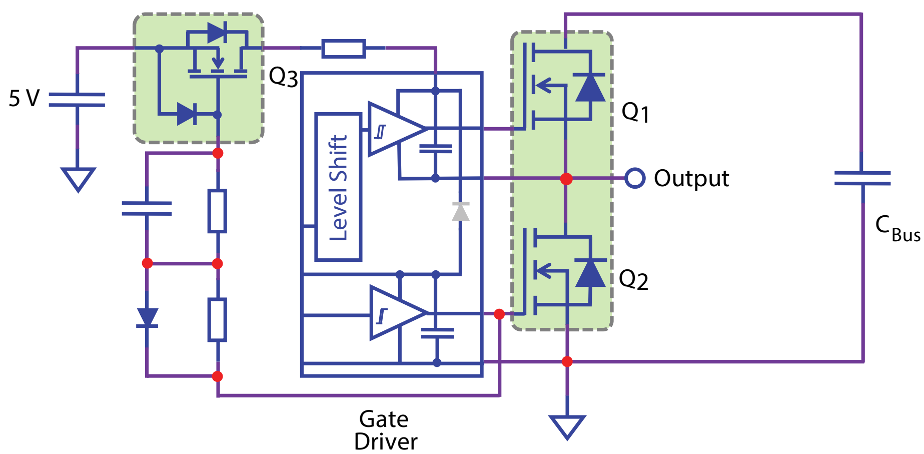
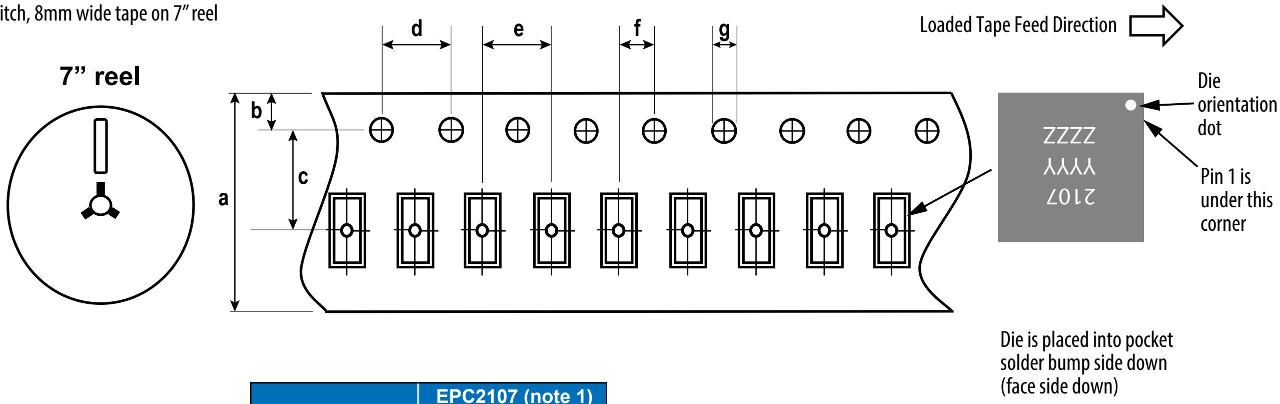


Figure 14: Typical Application Circuit



TAPE AND REEL CONFIGURATION

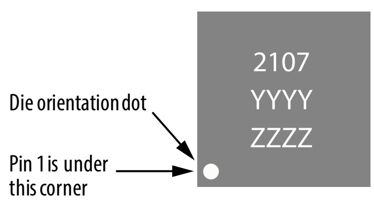
4mm pitch, 8mm wide tape on 7" reel



	EPC2107 (note 1)		
Dimension (mm)	target	min	max
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (see note)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (see note)	2.00	1.95	2.05
g	1.5	1.5	1.6

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.

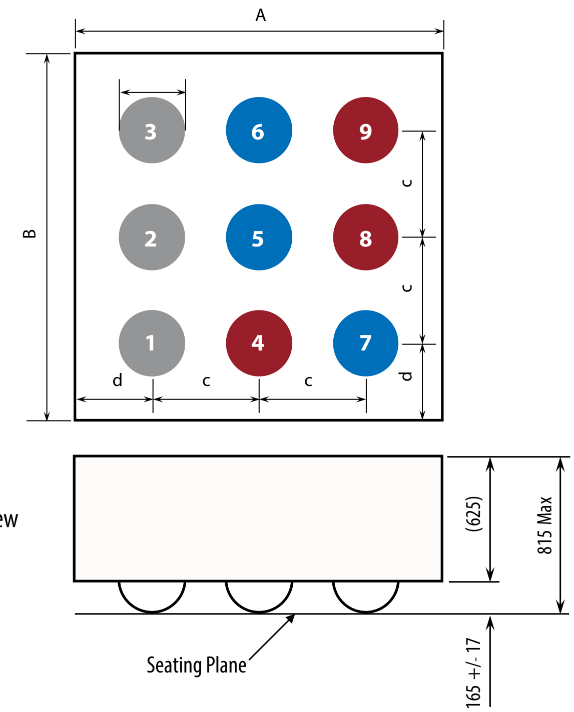
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2107	2107	YYYY	ZZZZ

DIE OUTLINE

Solder Bump View

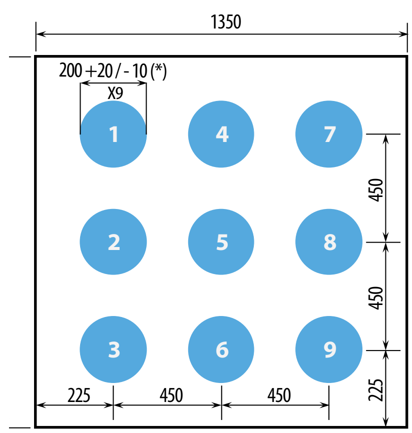


DIM	Micrometers		
	MIN	Nominal	MAX
A	1320	1350	1380
B	1320	1350	1380
c	450	450	450
d	210	225	240
e	187	208	229

Pad 1 is Gate1 (Q1)
Pad 2 is Gate2 (Q2)
Pad 3 is Gate 3 (Q3)
Pad 7 is Drain1 (Q1)
Pad 5 is Drain2 (Q2)
Pad 6 is Drain3 (Q3)
Pad 4 is Source1 (Q1)
Pad 8 is Source2 (Q2)
Pad 9 is Source3 (Q3)

RECOMMENDED LAND PATTERN

(measurements in µm)

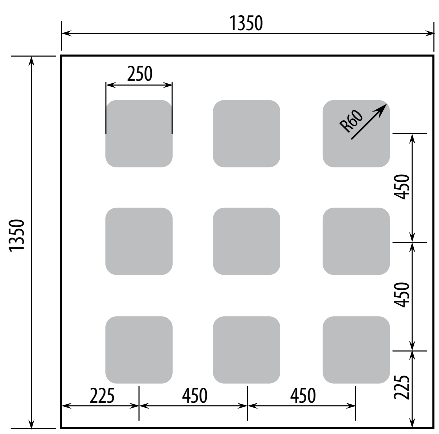


* minimum 190

The land pattern is solder mask defined.

RECOMMENDED STENCIL DRAWING

(measurements in µm)



Recommended stencil should be 4 mil (100 µm) thick, must be laser cut, openings per drawing.

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

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