

EPC2106 – Enhancement-Mode GaN Power Transistor Half-Bridge

V_{DS} , 100 V

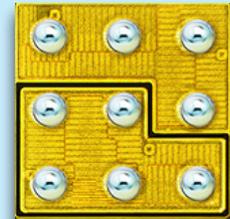
$R_{DS(on)}$, 70 mΩ

I_D , 1.7 A



Revised January 27, 2021

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.



Die Size: 1.35 x 1.35 mm

EPC2106 eGaN® ICs are supplied only in passivated die form with solder bumps.

Applications

- High frequency DC-DC conversion
- Class-D audio

Benefits

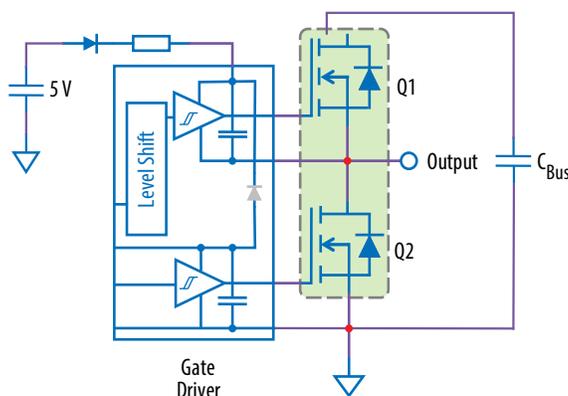
- Ultra high efficiency
- Ultra low $R_{DS(on)}$
- Ultra low Q_G
- Ultra small footprint

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 ($T_A = 25^\circ\text{C}$, $R_{\theta JA} = 320^\circ\text{C/W}$)	1.7	A
		Pulsed (25°C , $T_{PULSE} = 300 \mu\text{s}$)	18	
	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	

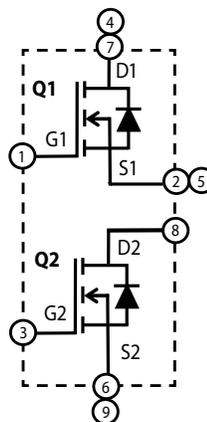
Thermal Characteristics			
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	30	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	81	

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

Typical Application Circuit



EPC2106 – Detailed Schematic



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



<https://l.ead.me/EPC2106>

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

DEVICE	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Q1 & Q2	BV_{DSS}	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}, I_D = 0.3\text{ mA}$	100			V
	I_{DSS}	Drain-Source Leakage	$V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$		0.001	0.25	mA
	I_{GSS}	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}$		0.01	1	mA
		Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		0.001	0.25	mA
	$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 0.6\text{ mA}$	0.8	1.4	2.5	V
	$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}, I_D = 2\text{ A}$		55	70	m Ω
	V_{SD}	Source-Drain Forward Voltage	$I_S = 0.35\text{ A}, V_{GS} = 0\text{ V}$		2.1		V

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

DEVICE	PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Q1	C_{ISS}	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		79	95	pF
	C_{RSS}	Reverse Transfer Capacitance			0.5		
	C_{OSS}	Output Capacitance			52	78	
	$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0\text{ V}$		63		pF
	$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			79		
	R_G	Gate Resistance			1.3		Ω
	Q_G	Total Gate Charge	$V_{DS} = 50\text{ V}, V_{GS} = 5\text{ V}, I_D = 2\text{ A}$		730	900	pC
	Q_{GS}	Gate to Source Charge			240		
	Q_{GD}	Gate to Drain Charge			140		
	$Q_{G(TH)}$	Gate Charge at Threshold			165		pC
	Q_{OSS}	Output Charge	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		3960	5940	
	Q_{RR}	Source-Drain Recovery Charge			0		
Q2	C_{ISS}	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		79	95	pF
	C_{RSS}	Reverse Transfer Capacitance			0.5		
	C_{OSS}	Output Capacitance			61	92	
	$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0\text{ V}$		74		pF
	$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			94		
	R_G	Gate Resistance			1.8		Ω
	Q_G	Total Gate Charge	$V_{DS} = 50\text{ V}, V_{GS} = 5\text{ V}, I_D = 2\text{ A}$		730	900	pC
	Q_{GS}	Gate to Source Charge			240		
	Q_{GD}	Gate to Drain Charge			140		
	$Q_{G(TH)}$	Gate Charge at Threshold			165		pC
	Q_{OSS}	Output Charge	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		4680	7020	
	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: $C_{OSS(TR)}$ 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 (Q1 & Q2): Typical Output Characteristics at 25°C

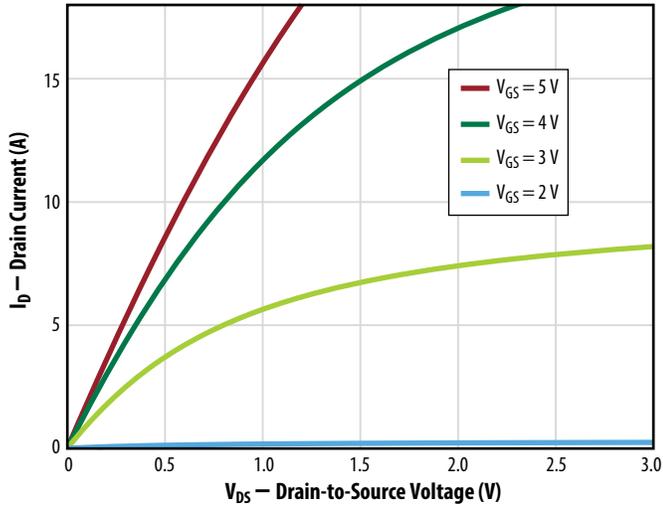


Figure 2 (Q1 & Q2): Typical Transfer Characteristics

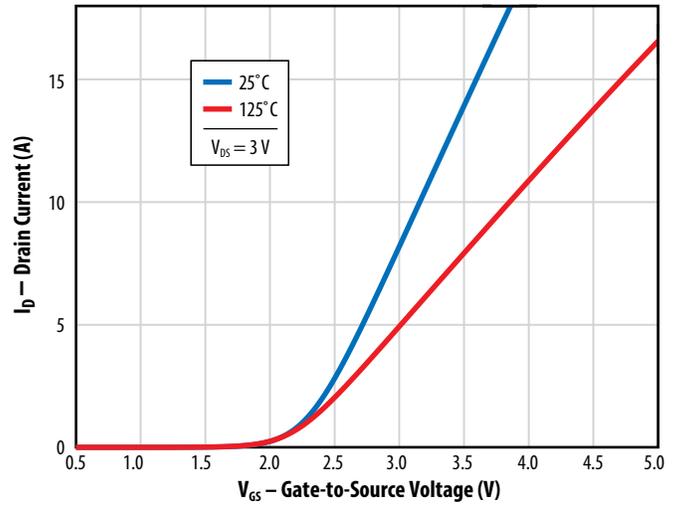


Figure 3 (Q1 & Q2): Typical $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

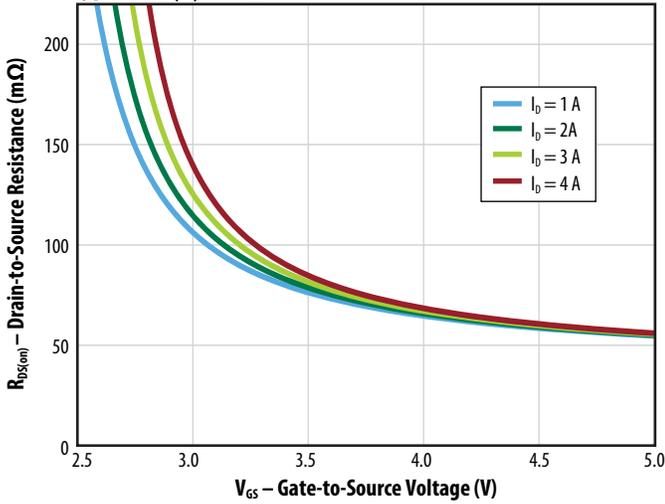


Figure 4 (Q1 & Q2): Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

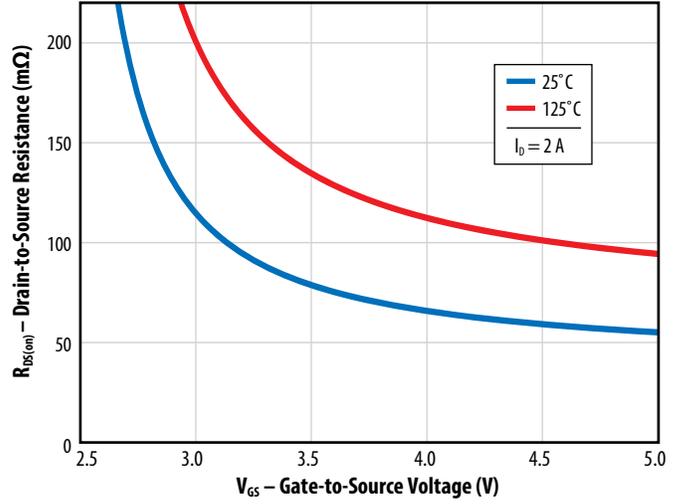


Figure 5a (Q1): Typical Capacitance (Linear Scale)

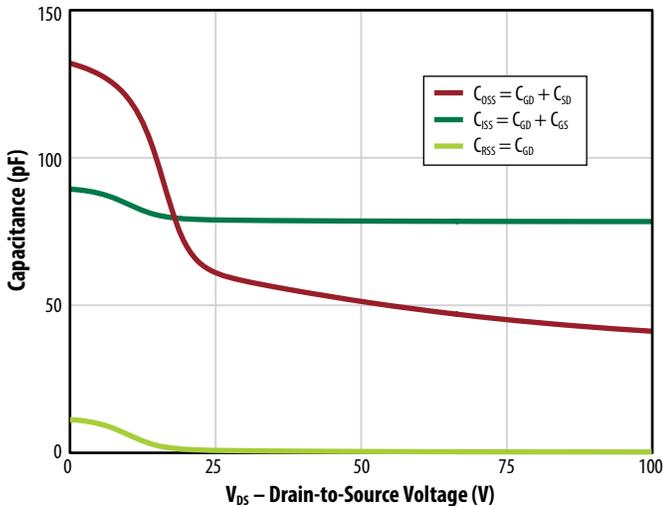


Figure 5b (Q1): Typical Capacitance (Log Scale)

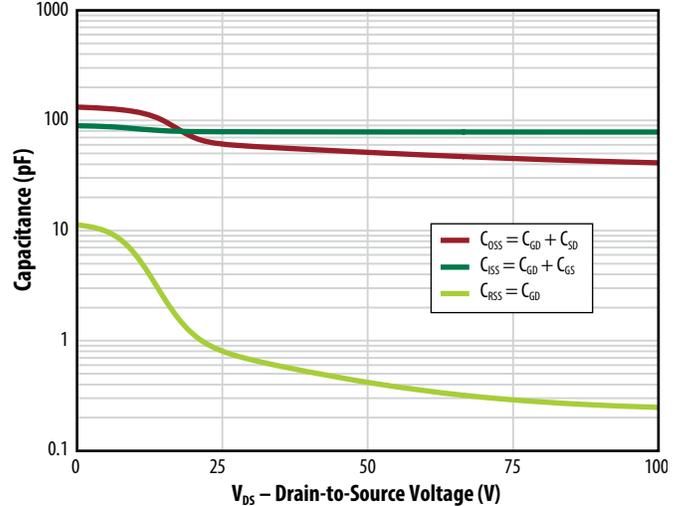


Figure 5c (Q2): Typical Capacitance (Linear Scale)

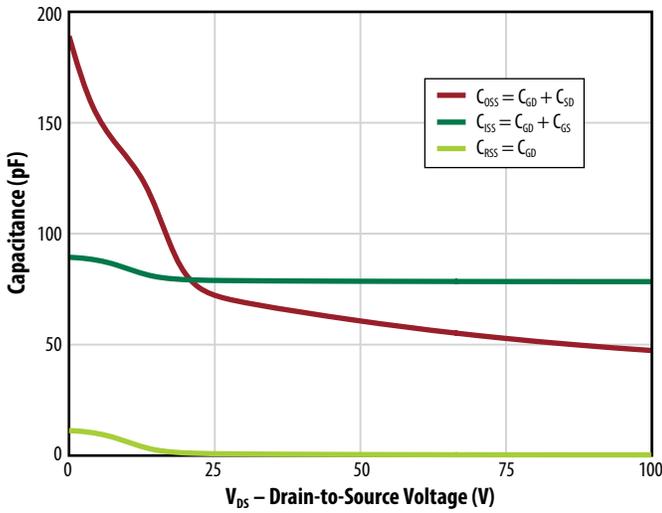


Figure 5d (Q2): Typical Capacitance (Log Scale)

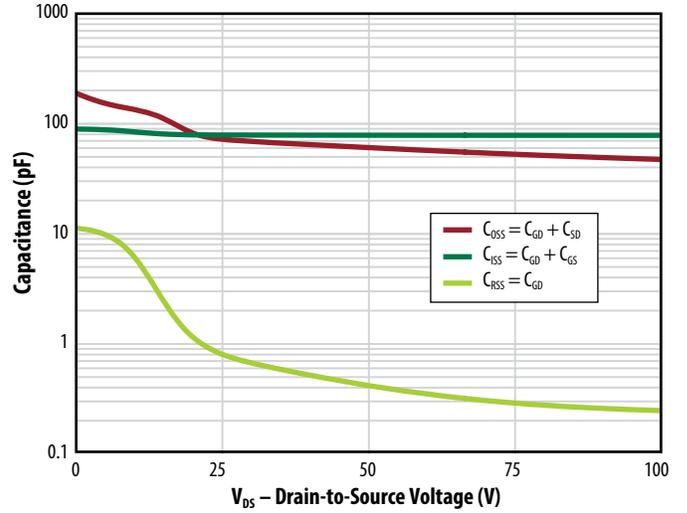


Figure 6a (Q1): Typical Output Charge and C_{oss} Stored Energy

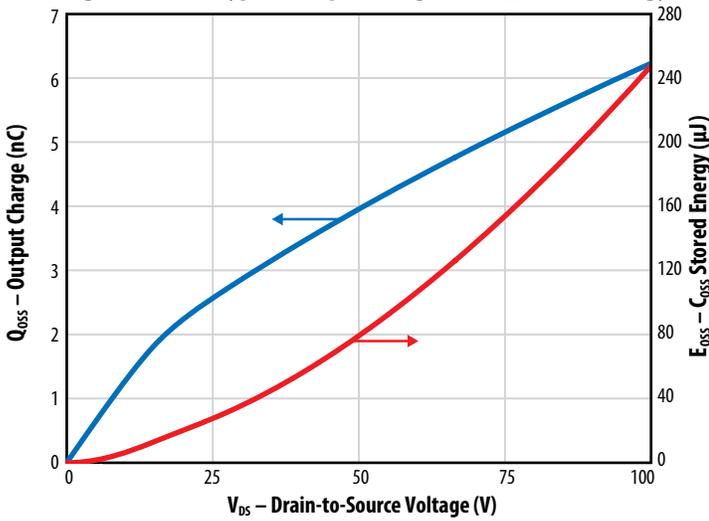


Figure 6b (Q2): Typical Output Charge and C_{oss} Stored Energy

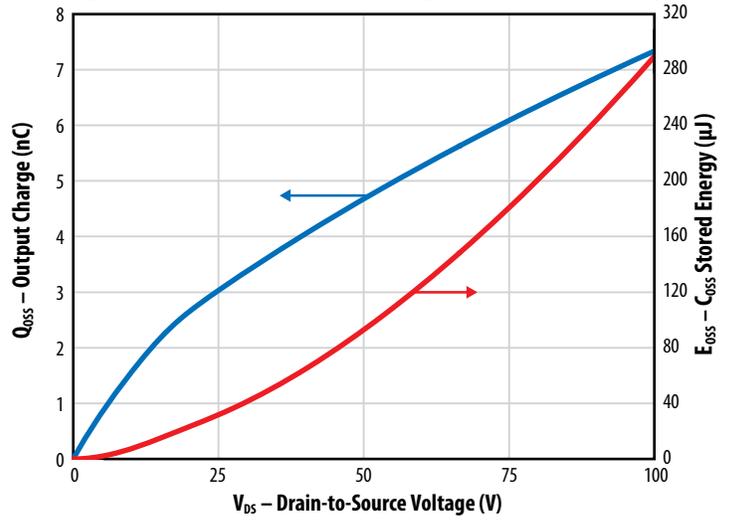


Figure 7 (Q1 & Q2): Typical Gate Charge

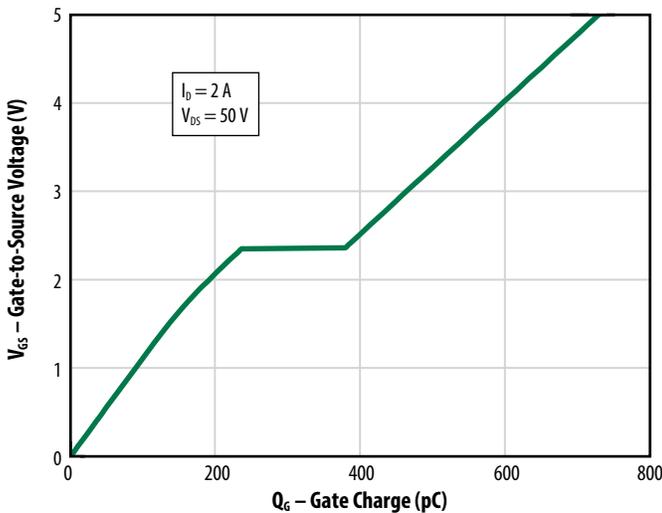
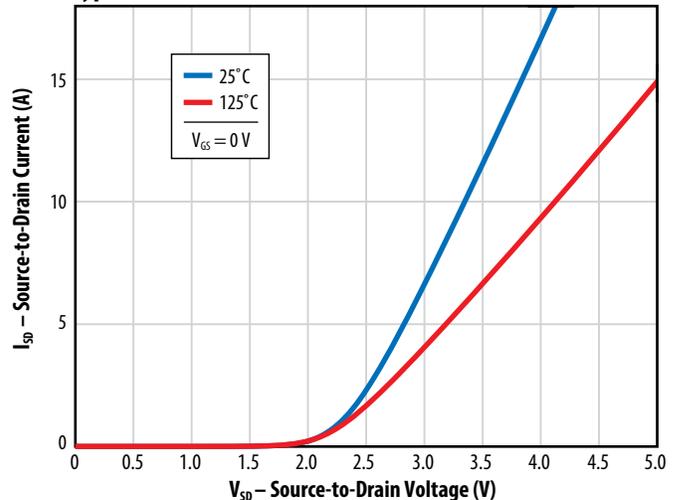
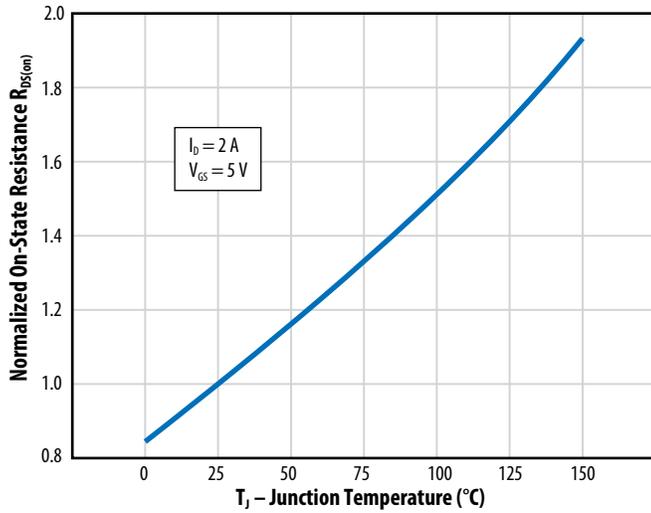


Figure 8 (Q1 & Q2): Typical Reverse Drain-Source Characteristics



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

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



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

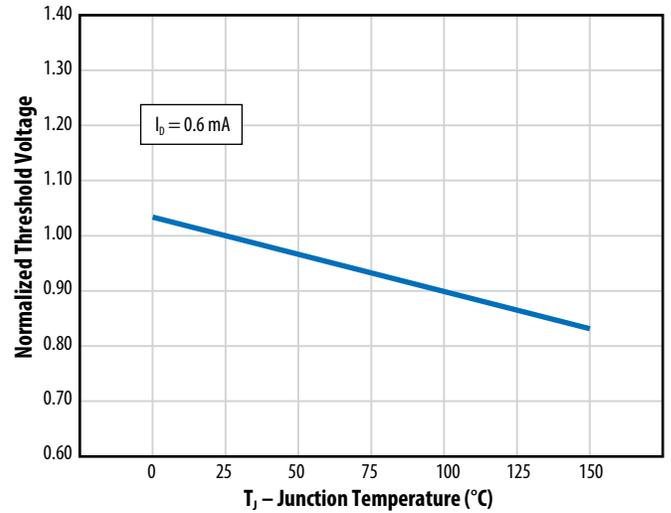


Figure 12 (Q1 & Q2): Typical Transient Thermal Response Curves

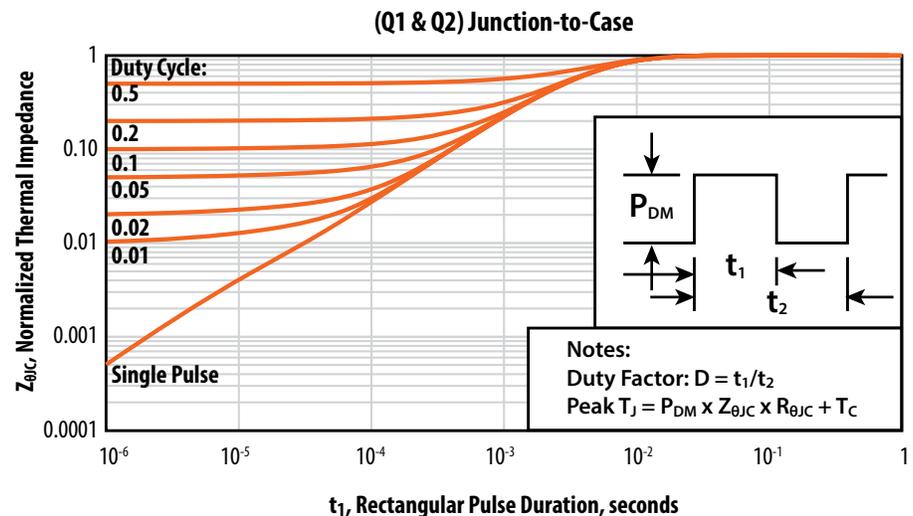
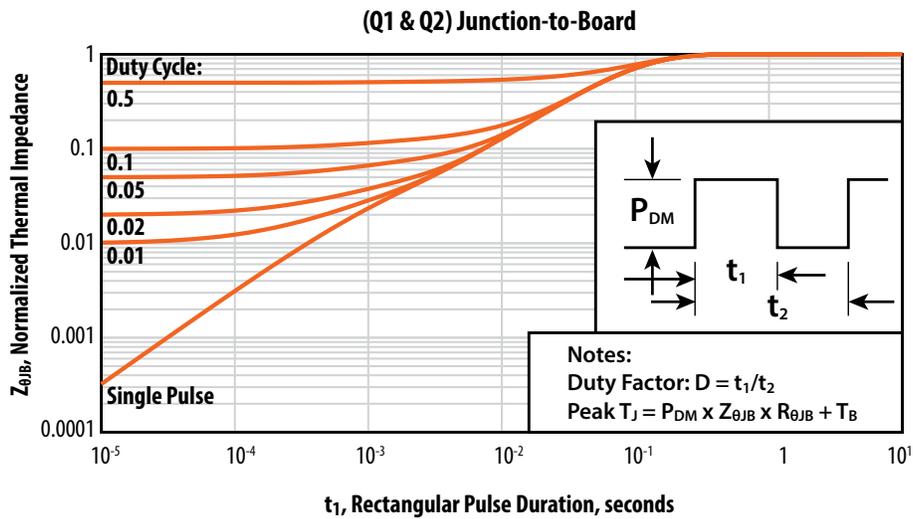
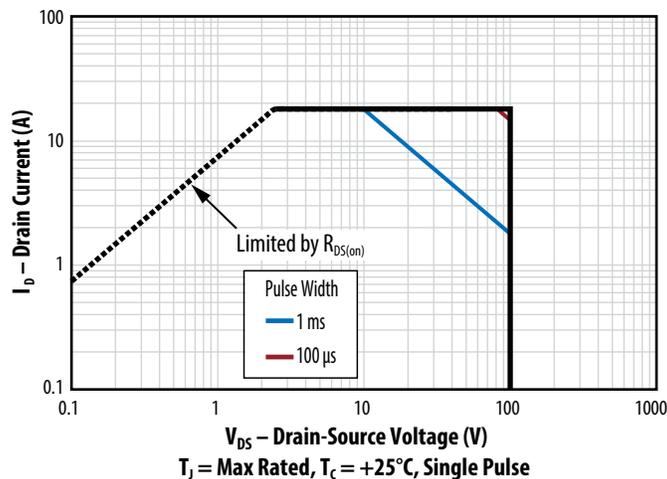
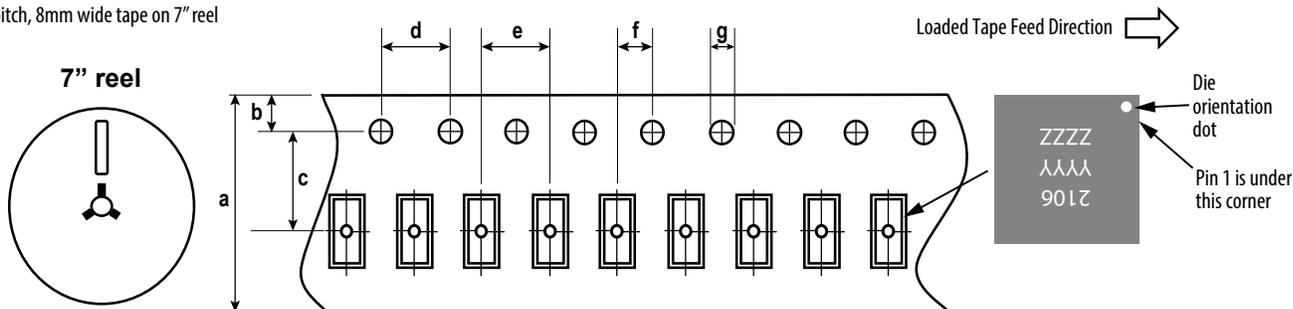


Figure 12 (Q1 & Q2): Safe Operating Area



TAPE AND REEL CONFIGURATION

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

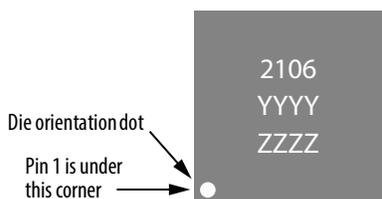


Die is placed into pocket solder bump side down (face side down)

Dimension (mm)	EPC2106 (note 1)		
	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

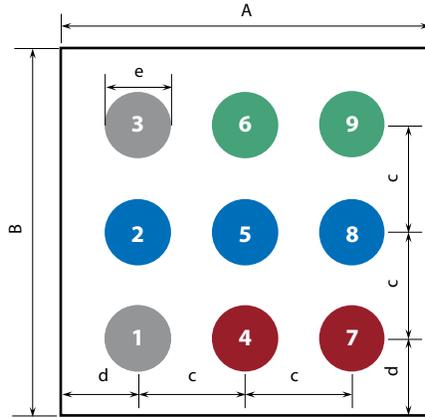
Note 1: MSL 1 (moisture sensitivity level 1) classified according to IPC/JEDEC industry standard.
 Note 2: Pocket position is relative to the sprocket hole measured as true position of the pocket, not the pocket hole.

DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2106	2106	YYYY	ZZZZ

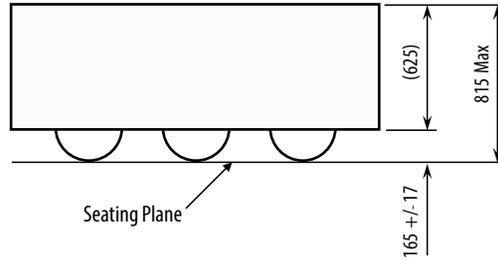
DIE OUTLINE
Solder Bump View



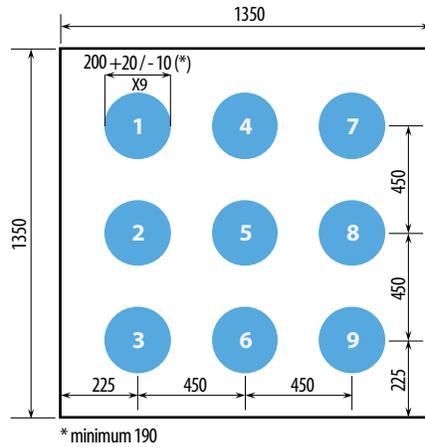
Pad 1 is Gate1 (high side)
Pad 3 is Gate2 (low side)
Pads 4, 7 are V_m
Pads 2, 5, 8 are Switch Node
Pads 6, 9 are Ground

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

Side View

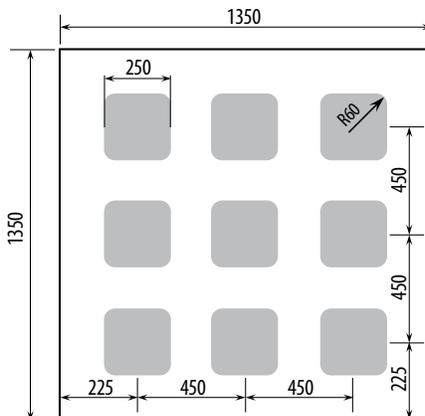


RECOMMENDED LAND PATTERN
(measurements in μm)



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/DesignSupport/AssemblyBasics.aspx>

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