Enhancement-Mode Gallium Nitride Technology

AVE ADDED VALUE ELECTRONICS

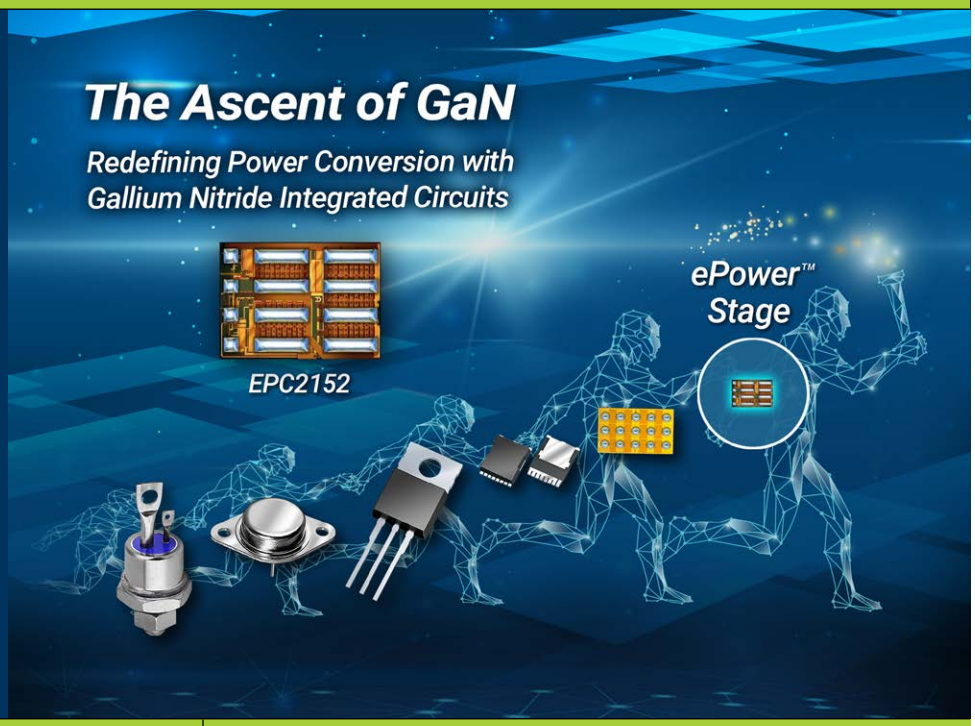
EPC EFFICIENT POWER CONVERSION

The End of the Road for Silicon…

Disruptive solutions offer a path to new levels of end product differentiation...*Gallium nitride is a disruptive solution!*

Advantages of GaN FETs and ICs vs. silicon in your power designs:

- ***Faster switching speed***
- ***Smaller size***
- ***Higher efficiency***
- ***Lower cost***



GaN Enables New Capabilities

- **Lower on resistance** – lower conductance losses
- **Faster devices** – less switching losses and no reverse recovery
- **Less capacitance** – less losses when charging and discharging devices
- **Less power** needed to drive the circuit
- **Smaller devices** take up less space on the printed circuit board
- **Lower cost**

GaN is Easy To Use

- **Works like an N-channel MOSFET only MUCH faster**
- **Integration** – saves space, improves efficiency, simplifies design, AND lowers cost.
- **Comprehensive design support** – device models, application notes, demo boards, technical articles

GaN is Cost Effective

- **GaN on silicon** – inexpensive substrate
- **Built in existing CMOS fab** – mature, low cost process
- **Lowers system cost** – smaller and fewer passive components

GaN is Reliable

AEC-Q101 Qualified

- **Proven technology -** Phase Ten reliability report published after 85 billion hours in the field
- **Secure supply chain**
- **GaN is inherently radiation tolerant**

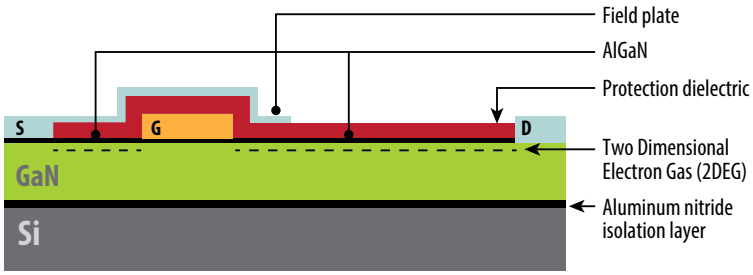
Enhancement-Mode Gallium Nitride (eGaN®) Transistors and Integrated Circuits

A GaN transistor is a wide bandgap device with superior conductivity compared to traditional silicon transistors resulting in smaller devices and lower capacitance for the same $R_{DS(on)}$.

Enhancement-mode (normally-off) operation allows power designers to take advantage of the performance benefits of gallium nitride in a switching application.

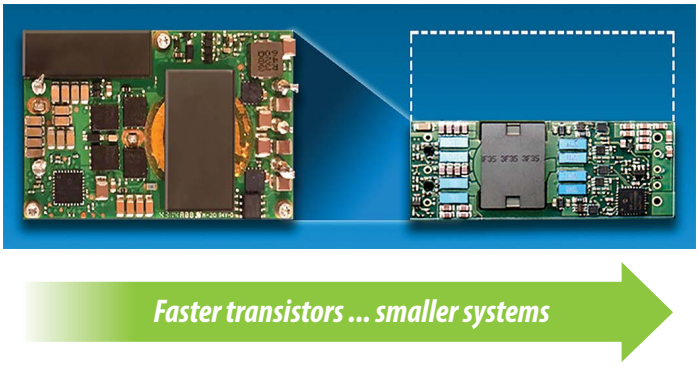
Capacitance and inductance impede switching speed. eGaN FETs' small size and lateral structure give ultra low capacitance while the chip-scale packaging gives low inductance enabling unprecedented switching performance in terms of speed, voltage overshoot and ringing. Zero Q_{RR} also reduces losses at high frequency.

The switching performance of eGaN FETs and ICs enables higher power density, higher frequency, higher switching precision, higher bus voltage, and less voltage overhead. The technology can be scaled over many power and voltage levels.



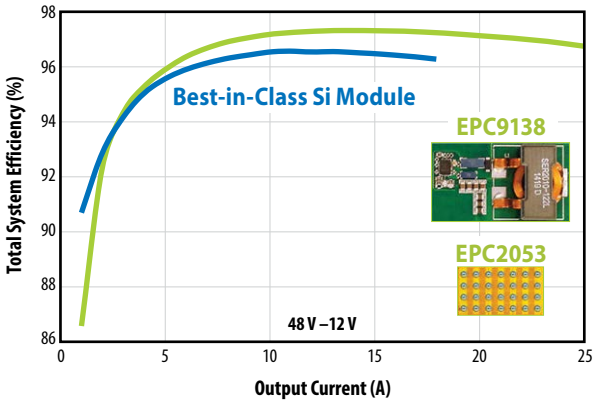
eGaN transistors and ICs are *faster*

Smaller, more efficient, and lower cost.



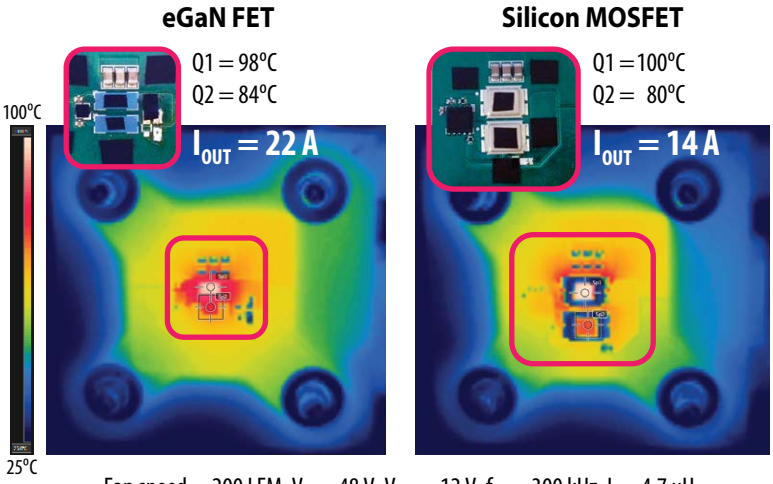
eGaN transistors and ICs are *more efficient*

Increased efficiency AND power.



eGaN transistors and ICs are *more thermally efficient for unmatched power density*

eGaN FET design delivers 60% more output power in less than half the board area.



Fan speed = 200 LFM, V_{IN} = 48 V, V_{OUT} = 12 V, f_{sw} = 300 kHz, L = 4.7 µH

Design Support Available @ www.epc-co.com

eGaN FETs and ICs (15 V – 80 V)

Part Number	Configuration	V_{DS}	Max $R_{DS(on)}$ (mΩ) @ 5 V_{GS}	Q_G typ (nC)	Q_{GS} typ (nC)	Q_{GD} typ (nC)	Q_{OSS} typ (nC)	Q_{RR} (nC)	I_D (A)	Pulsed I_D (A)	Package (mm)	Development Board
EPC2040	Single	15	30	0.745	0.23	0.14	0.42	0	3.4	28	BGA 0.85 x 1.2	n/a
EPC2216	Single – AEC-Q101	15	26	0.87	0.21	0.13	0.53	0	3.4	28	BGA 0.85 x 1.2	EPC9144
EPC2111	Half Bridge	30	19 8	1.7 4.5	0.6 1.4	0.3 0.8	3.3 9.6	0	16	50 140	BGA 3.5 x 1.5	EPC9086
EPC2100	Half Bridge	30	8.2 2.1	3.6 15	1.3 4.8	0.6 2.7	6.1 29	0	10 40	100 400	BGA 6.05 x 2.3	EPC9036
EPC2023	Single	30	1.45	19	5.7	3.2	30	0	90	590	LGA 6.05 x 2.3	EPC9031
EPC8004	Single	40	110	0.37	0.12	0.047	0.63	0	4	7.5	LGA 2.05 x 0.85	EPC9024
EPC2014C	Single	40	16	2	0.7	0.3	4	0	10	60	LGA 1.7 x 1.1	EPC9005C
EPC2015C	Single	40	4	8.7	2.7	1.2	19	0	53	235	LGA 4.1 x 1.6	EPC9001C
EPC2055	Single	40	3.6	6.6	2.3	0.7	13	0	29	161	LGA 2.5 x 1.5	EPC90132
EPC2030	Single	40	2.4	17	5.8	3.4	32	0	48	490	BGA 4.6 x 2.6	EPC9060
EPC2069	Single	40	2.25	12.5	3.9	2.4	32	0	80	422	LGA 3.25 x 3.25	EPC90139
EPC2067	Single	40	1.55	17.1	5.3	2	37	0	69	409	LGA 2.85 x 3.25	EPC90138
EPC2024	Single	40	1.5	18	5.1	2.4	45	0	90	560	LGA 6.05 x 2.3	EPC9032
EPC7014	Single Rad Hard	60	340	142	43	25	764	0	2	4	BGA 0.9 x 0.9	n/a
EPC2108	Dual with Sync Boot	60	240 3300	0.24 0.044	0.106 0.02	0.047 0.004	0.71 0.93 0.134	0	1.7 0.5	5.5 0.5	BGA 1.35 x 1.35	EPC9064
EPC2035	Single	60	45	0.88	0.25	0.16	2.6	0	1.7	24	BGA 0.9 x 0.9	EPC9049
EPC2102	Half Bridge	60	4.9	8	2.5	1.5	26 31	0	30	220	BGA 6.05 x 2.3	EPC9038
EPC2031	Single	60	2.6	16	5	3.2	48	0	48	450	BGA 4.6 x 2.6	EPC9061
EPC2101	Half Bridge	60	11.5 2.8	3.3 13	1.1 3.9	0.5 2.2	9.3 45	0	10 40	80 350	BGA 6.05 x 2.3	EPC9037
EPC2020	Single	60	2.2	16	3.9	2.3	50	0	90	470	LGA 6.05 x 2.3	EPC9033
EPC2219	Single with Gate Diode – AEC-Q101	65	3300	0.044	0.02	0.004	0.104	0	0.5	0.5	BGA 0.9 x 0.9	n/a
EPC8002	Single	65	480	0.133	0.057	0.015	0.344	0	2	2	LGA 2.05 x 0.85	EPC9022
EPC8009	Single	65	130	0.37	0.12	0.055	0.94	0	4	7.5	LGA 2.05 x 0.85	EPC9029
EPC2203	Single – AEC-Q101	80	80	0.67	0.22	0.12	3.6	0	1.7	17	BGA 0.9 x 0.9	n/a
EPC2039	Single	80	25	1.91	0.76	0.42	7.64	0	6.8	50	BGA 1.35 x 1.35	EPC9057
EPC2214	Single – AEC-Q101	80	20	1.8	0.5	0.3	8	0	10	47	BGA 1.35 x 1.35	n/a
EPC2202	Single – AEC-Q101	80	17	3.2	1	0.55	18	0	18	75	LGA 2.1 x 1.6	n/a
EPC2103	Half Bridge	80	5.5	6.5	2.2	1.1	30 34	0	30	195	BGA 6.05 x 2.3	EPC9039
EPC2065	Single	80	3.6	9.4	2.6	1.7	33	0	60	215	LGA 3.5 x 2	EPC90137
EPC2029	Single	80	3.2	13	3.4	1.9	53	0	48	360	BGA 4.6 x 2.6	EPC9046
EPC2105	Half Bridge	80	14.5 3.6	2.7 11	0.9 3	0.5 2.1	11 51	0	10 40	70 300	BGA 6.05 x 2.3	EPC9041
EPC2021	Single	80	2.2	15	4.1	3	72	0	90	390	LGA 6.05 x 2.3	EPC9034
EPC2206	Single – AEC-Q101	80	2.2	15	4.1	3	72	0	90	390	LGA 6.05 x 2.3	EPC90122

Table data subject to change. Please visit: **www.epc-co.com/epc/Products/eGaNFETsandICs.aspx**

eGaN FETs and ICs (100 V – 350 V)

Part Number	Configuration	V_{DS}	Max $R_{DS(on)}$ (mΩ) @ 5 V_{GS}	Q_G typ (nC)	Q_{GS} typ (nC)	Q_{GD} typ (nC)	Q_{OSS} typ (nC)	Q_{RR} (nC)	I_D (A)	Pulsed I_D (A)	Package (mm)	Development Board
EPC2038	Single with Gate Diode	100	3300	0.044	0.02	0.004	0.134	0	0.5	0.5	BGA 0.9 x 0.9	EPC9507
EPC2037	Single	100	550	0.115	0.032	0.025	0.6	0	1.7	2.4	BGA 0.9 x 0.9	EPC9061
EPC2107	Dual with Sync Boot	100	390 3300	0.19 0.044	0.077 0.02	0.041 0.004	0.9 1.25 0.134	0	1.7 0.5	3.8 0.5	BGA 1.35 x 1.35	EPC9063
EPC8010	Single	100	160	0.36	0.13	0.06	2.2	0	4	7.5	LGA 2.05 x 0.85	EPC9030
EPC2036	Single	100	73	0.7	0.17	0.14	3.9	0	1.7	18	BGA 0.9 x 0.9	EPC9050
EPC2106	Half Bridge	100	70	0.73	0.24	0.140	3.96 4.68	0	1.7	18	BGA 1.35 x 1.35	EPC9055
EPC2007C	Single	100	30	1.6	0.6	0.3	8.3	0	6	40	LGA 1.7 x 1.1	EPC9006C
EPC2051	Single	100	25	1.8	0.6	0.3	7.3	0	1.7	37	BGA 1.3 x 0.85	EPC9091
EPC2016C	Single	100	16	3.4	1.1	0.55	16	0	18	75	LGA 2.1 x 1.6	EPC9010C
EPC2212	Single – AEC-Q101	100	13.5	3.2	0.9	0.6	18	0	18	75	LGA 2.1 x 1.6	n/a
EPC2052	Single	100	13.5	3.5	1.5	0.5	13	0	8.2	74	BGA 1.5 x 1.5	EPC9092
EPC2045	Single	100	7	6	1.9	0.8	25	0	16	130	BGA 2.5 x 1.5	EPC9078
EPC2001C	Single	100	7	7.5	2.4	1.2	31	0	36	150	LGA 4.1 x 1.6	EPC9002C
EPC2104	Half Bridge	100	6.8	6.8	2.3	1.4	35 41	0	30	180	BGA 6.05 x 2.3	EPC9040
EPC2204	Single	100	6	5.7	1.8	0.8	25	0	29	125	LGA 2.5 x 1.5	EPC9097
EPC2032	Single	100	4	12	3	2	66	0	48	340	BGA 4.6 x 2.6	EPC9062
EPC2053	Single	100	3.8	11.4	4.1	1.5	45	0	48	246	BGA 3.5 x 2	EPC9093
EPC2218	Single	100	3.2	10.5	3.2	1.5	46	0	60	231	LGA 3.5 x 1.95	EPC90123
EPC2022	Single	100	3.2	13.2	3.4	2.4	71	0	90	390	LGA 6.05 x 2.3	EPC9035
EPC2302	Single	100	1.8	23	8	2.3	85	0	101	408	QFN 3 x 5	EPC90142
EPC2110	Dual Common Source	120	110	0.8	0.25	0.18	4	0	3.4	20	BGA 1.35 x 1.35	EPC9058
EPC2033	Single	150	7	12	3.8	3.2	90	0	48	260	BGA 4.6 x 2.6	EPC9047
EPC2059	Single	170	9	5.7	1.3	0.9	35	0	24	102	LGA 2.8 x 1.4	EPC9098
EPC2012C	Single	200	100	1	0.3	0.2	10	0	5	22	LGA 1.7 x 0.9	EPC9004C
EPC2019	Single	200	50	1.8	0.6	0.35	18	0	8.5	42	LGA 2.77 x 0.95	EPC9014
EPC2054	Single	200	43	2.9	0.9	0.30	15	0	3.0	32	BGA 1.3 x 1.3	EPC9094
EPC2010C	Single	200	25	3.7	1.3	0.7	40	0	22	90	LGA 3.6 x 1.6	EPC9003C
EPC2207	Single	200	22	4.5	1.3	0.7	23	0	14	54	LGA 2.9 x 0.9	EPC90124
EPC2034	Single	200	10	8.8	3	1.8	75	0	48	200	BGA 4.6 x 2.6	EPC9048
EPC2215	Single	200	8	13.6	3.3	2.1	69	0	32	162	LGA 4.6 x 1.6	EPC9099
EPC2034C	Single	200	8	11.4	3.8	2.1	95	0	48	213	BGA 4.6 x 2.6	EPC9048C
EPC2050	Single	350	65	3.8	1.2	0.4	36	0	6.3	26	BGA 1.95 x 1.95	EPC9084

eGaN® Integrated Circuits

ePower™ Stage

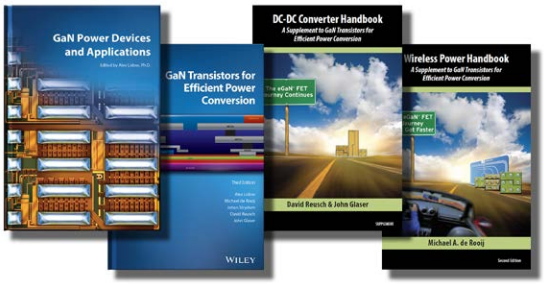
Part Number	Configuration	Function	VPwr	I_{OUT}	I_{OUT} Peak	V_{DD}	Input Logic	F (Max)	UVLO	Package (mm)	Development Board
EPC2152	Half-Bridge ePower™ Stage	ePower™ Stage	80	12.5	90	12	3.3 V	3 MHz	7.5	LGA 3.65 x 2.59	EPC90120
EPC23101	HS FET + Driver + Level Shift	ePower™ Stage	100	65	240	6	5.5 V	3 MHz	0.5 - 4 V	QFN 3.5 x 5	EPC90142

eToF™ Laser Driver IC

Part Number	Configuration	Function	V	I_{OUT}	I_{OUT} Peak	V_{DD}	Input Logic	F (Max)	UVLO	Package (mm)	Development Board
EPC21601	Single	eToF™ Laser Driver	40	3.7	10	5	3.3 V	200	0	BGA 1 x 1.5	EPC9154
EPC21603	Single	eToF™ Laser Driver	40	3.7	10	5	LVDS	200	0	BGA 1 x 1.5	EPC9156

Table data subject to change. Please visit: www.epc-co.com/epc/Products/eGaNFETsandICs.aspx

Advancing the Learning Curve



Applications

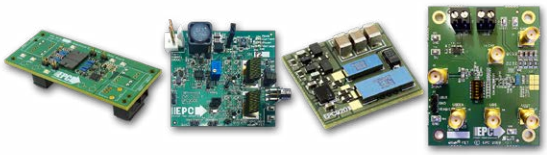
- **Automotive** – AEC-Q101 Qualified FETs
- **DC-DC Converter** – higher power density
- **POL Converter** – higher efficiency with better transient response
- **Lidar** – Short pulse width at high current equal high resolution imaging
- **Class-D Audio** – smaller with better sound quality
- **Wireless Power** – eGaN FETs and ICs are perfect for 6.78 MHz frequency
- **Envelope Tracking** – Double the efficiency of RF power amplifier
- **RF Amplifier** – lower cost below 2 GHz
- **Motor Drive** – higher frequency reduces motor size
- **Medical** – enhanced image resolution at lower cost
- **Analog Switching** – higher power and higher frequency at higher voltages
- **LED Lighting** – higher power density and better control

Demonstration Boards for eGaN FETs and IC's Available:

Part Number	Description	Focus Application	Featured Product
EPC9162	Bidirectional 50 W (Boost) / 60 W (Buck) Evaluation Module	DC-DC	EPC2052
EPC9157	300 W $^1/_{16}$th Brick Evaluation Module, 18 V to 60 V, 25 A	DC-DC	EPC2218
EPC9143	300 W $^1/_{16}$th Brick Evaluation Module, 18 V to 60 V, 25 A	DC-DC	EPC2053
EPC9151	300 W Bidirectional $^1/_{16}$th Brick Evaluation Module	DC-DC	EPC2152
EPC9163	2 kW 48 V/12 V Bidirectional Power Module	DC-DC	EPC2218
EPC9137	1.5 kW 48 V/12 V Bidirectional Power Module	DC-DC	EPC2206
EPC9149	1 kW 48 V - 12 V LLC $^1/_8$th Brick Evaluation Module	DC-DC	EPC2218 / EPC2024
EPC9148	48 V - 19 V Ultra-thin, Multi-level Converter, 44 V to 60 V, 12.5 A	DC-DC	EPC2053
EPC9153	250 W High Efficiency, Thin Buck Converter, 44 V to 60 V, 12.5 A	DC-DC	EPC2218
EPC9166	500 W 12 V Input Boost Converter	DC-DC	EPC2218
EPC9118	48 V to 5 V Non-Isolated Buck Converter	DC-DC	EPC2001C / EPC2021
EPC9115	500 W $^1/_8$th Brick Converter, 48 V to 60 V, 42 A	DC-DC	EPC2020 / EPC2021
EPC9144	Laser Diode Driver Demo Board, 28 A Pulse Capable	Lidar	EPC2216
EPC9154	Laser Diode Driver Demo Board, 10 A Pulse Capable	Lidar	EPC21601
EPC9156	Laser Diode Driver Demo Board, 10 A Pulse Capable	Lidar	EPC21603
EPC9126	Laser Diode Driver Demo Board, 75 A Pulse Capable	Lidar	EPC2212
EPC9126HC	Laser Diode Driver Demo Board, 150 A Pulse Capable	Lidar	EPC2001C
EPC9150	Laser Diode Driver Demo Board, 220 A Pulse Capable	Lidar	EPC2034C
EPC9127	10 W Class 2 Wireless Demo Kit	Wireless Power	EPC2107 / EPC2036 / EPC2019
EPC9128	16 W Class 3 Wireless Demo Kit	Wireless Power	EPC2108 / EPC2036 / EPC2019
EPC9129	33 W Class 4 Wirelesss Demo Kit Wireless Power	Wireless Power	EPC8010 / EPC2038 / EPC2019 / EPC2016C
EPC9121	10 W Multi-Mode Wireless Power Kit	Wireless Power	EPC2107 / EPC2038 / EPC2036
EPC9111 / EPC9112	ZVS Class D Wireless Demo Kit	Wireless Power	EPC2014C / EPC2007C / EPC2038
EPC950x	Amplifier Board for Wireless Power Demonstration System	Wireless Power	Varies
EPC9513 / EPC9515 / EPC9514	Category 3 (5 W) / Category 4 (10 W) / Category 5 (27 W) Wireless Receive Devices	Wireless Power	EPC2019 / EPC2019 / EPC2016C
EPC9146	400 W Motor Drive Demo	Motor Drive	EPC2152
EPC9145	1 kW Motor Drive Demo	Motor Drive	EPC2206

Product specifications are subject to change without notice.

Development Boards and Demonstration Circuits Speed Time to Market.



See the full listing of available boards at: www.epc-co.com/epc/Products/DemoBoards.aspx

EPC EFFICIENT POWER CONVERSION

Revised December, 2021

For More Information

Please contact info@epc-co.com or your local sales representative
Visit our website: epc-co.com / Sign-up to receive EPC updates at bit.ly/EPCupdates or text "EPC" to 22828

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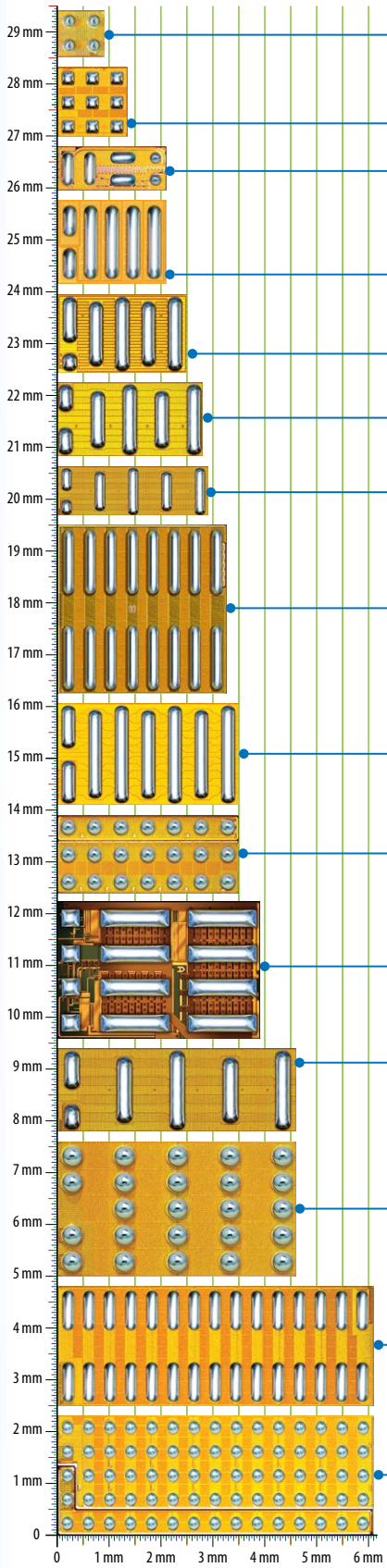


EPC7014: 60 V, 4 A
EPC2035: 60 V, 24 A
EPC2219: 65 V, 3300 A – **AEC-Q101 Qualified**
EPC2203: 80 V, 17 A – **AEC-Q101 Qualified**
EPC2036: 100 V, 18 A
EPC2037: 100 V, 2.4 A
EPC2038: 100 V with Gate Diode, 0.5 A

EPC2214: 80 V, 47 A – **AEC-Q101 Qualified**

EPC8004: 40 V, 7.5 A
EPC8002: 65 V, 2 A
EPC8009: 65 V, 7.5 A
EPC8010: 100 V, 7.5 A

EPC2202: 80 V, 75 A – **AEC-Q101 Qualified**
EPC2212: 100 V, 75 A – **AEC-Q101 Qualified**
EPC2016C: 100 V, 75 A

EPC2055: 40 V, 161 A
EPC2204: 100 V, 125 A

EPC2059: 170 V, 102 A

EPC2207: 200 V, 54 A

EPC2067: 40 V, 409 A
EPC2069: 40 V, 422 A

EPC2065: 80 V, 215 A
EPC2218: 100 V, 231 A

EPC2111: 30 V Asymmetric Half Bridge, 140 A / 50 A

EPC2152: 70 V ePower™ Stage, 12.5 A

EPC2215: 200 V, 162 A

EPC2030: 40 V, 490 A
EPC2031: 60 V, 450 A
EPC2029: 80 V, 360 A
EPC2032: 100 V, 340 A
EPC2033: 150 V, 260 A
EPC2034C: 200 V, 213 A

EPC2023: 30 V, 590 A
EPC2024: 40 V, 560 A
EPC2020: 60 V, 470 A
EPC2021: 80 V, 420 A
EPC2206: 80 V, 390 A – **AEC-Q101 Qualified**
EPC2022: 100 V, 390 A

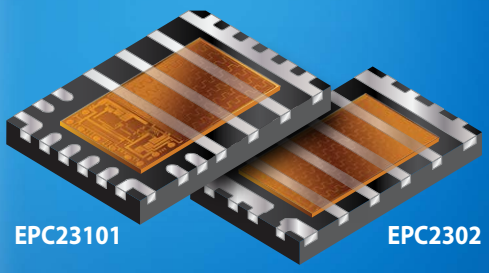
EPC2100: 30 V Asymmetrical Half Bridge, 400 A / 100 A
EPC2101: 60 V Asymmetrical Half Bridge, 350 A / 80 A
EPC2102: 60 V Symmetrical Half Bridge, 220 A
EPC2103: 80 V Symmetrical Half Bridge, 195 A
EPC2105: 80 V Asymmetrical Half Bridge, 300 A / 70 A
EPC2104: 100 V Symmetrical Half Bridge, 180 A

EPC
EFFICIENT POWER CONVERSION

Chip-Scale

A Better Power Package

- Double-sided cooling improves thermal performance
- Low inductance enables faster switching
- Elimination of plastic packages reduces size, cost, and improves reliability



100 V, 65 A ePower™ Chipset
Logic in → Power out

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