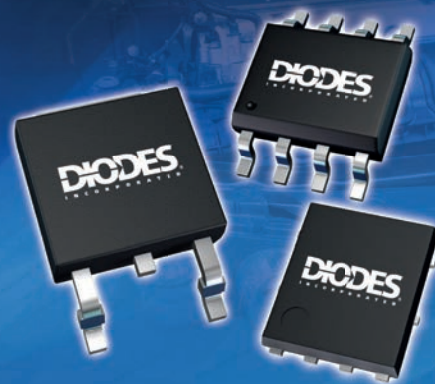




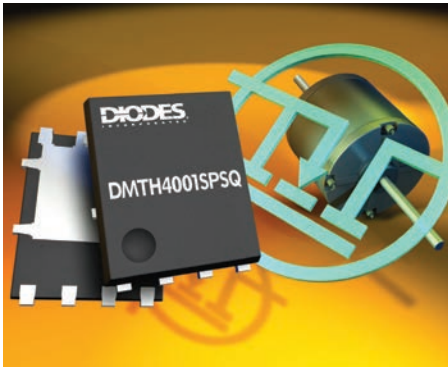
AUTOMOTIVE COMPLIANT

MOSFET

'Q' PORTFOLIO

- RATED TO +175°C
- AVALANCHE RUGGED
- QUALIFIED TO AEC-Q101 REV D
- SUPPORTED BY A PRODUCTION PART APPROVAL PROCESS (PPAP) DOCUMENT
- MANUFACTURED IN FACILITIES THAT HAVE BEEN AUDITED TO TS16949 AND VDA6.3
- ROHS COMPLIANT

diodes.com



BRUSHLESS DC MOTOR CONTROL

Brushless DC (BLDC) motor control provides improved performance, longer lifetime, reduced noise and greater ease of use when compared to equivalent mechanical solutions.

Consequently, three-phase BLDC systems are widely used in Automotive applications such as fuel pumps, water pumps, Anti-Lock Braking Systems (ABS) and provide additional torque for power steering systems.

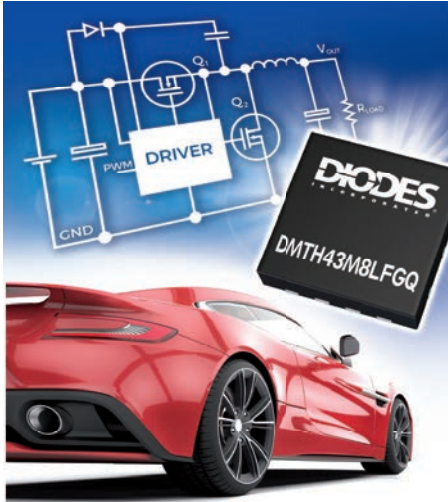
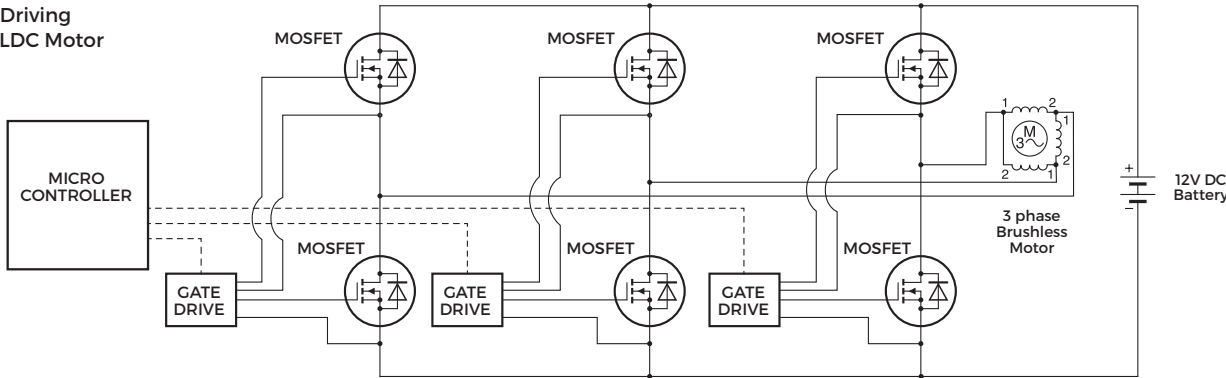
The motor power will depend on the vehicle application and performance.

In BLDC motor systems, MOSFETs are typically configured in a three-phase bridge arrangement to drive the DC motor and must be capable of handling start-up and stalled motor currents of up to six times the continuous current rating of the motor.

HIGHLIGHTED PRODUCT	
Product	Application
DMTH4001SPSQ	High-Power BLDC Designs
DMTH4003LPSQ	Medium-Power BLDC Designs

MOSFET REQUIREMENTS	
■ Low $R_{DS(ON)}$ – Reduced Conduction Losses	
■ Low Q_{GD} – Reduced Switching Losses	
■ 100% Avalanche Rated – Ensures robust design able to withstand the reverse avalanche energy generated by the BLDC	
■ Rated to +175°C – For use in high ambient temperature environments	
■ Low Thermal Resistance Package – Maintain Low Operating Temperature	

MOSFETs Driving 3-Phase BLDC Motor

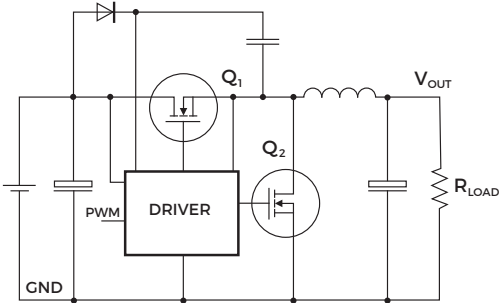


DC-DC CONVERSION

As well as the nominal maximum power that the DC-DC converter can deliver, the two MOSFETs need to handle voltage spikes caused by parasitic inductances and a current level equal to the maximum output current.

In high-frequency synchronous conversion topologies the high side MOSFET (Q1) can often be switched at frequencies twice that of the low side MOSFET (Q2). Therefore, the gate charge, gate resistance and input capacitance are key parameters, whereas for the low side MOSFET (Q2) it is usually conduction losses $R_{DS(ON)}$ that dominate.

Synchronous DC-DC Converter

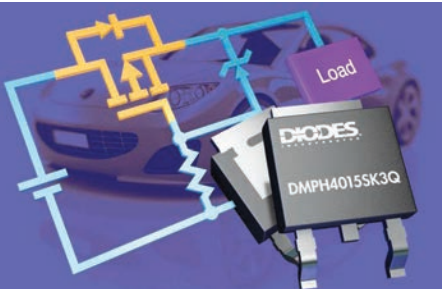


HIGHLIGHTED PRODUCT	
Product	Application
DMTH4008LDFWQ	High-Side
DMTH43M8LFGQ	Low-Side

MOSFET REQUIREMENTS	
High Side MOSFET (Q1)	
■ Low Gate Charge (Q_{GD}) ■ Low Gate Resistance (R_G) ■ Low Input Capacitance (C_{ISS})	
Low Side MOSFET (Q2)	
■ Low $R_{DS(ON)}$ – Minimise Conduction Losses	

MOSFET ‘Q’ PORTFOLIO

Part Number	Package	Polarity	V _{DS} (V)	V _{CESS} (V)	I _D (A)	V _{GSTH} (V)	R _{DS(ON) MAX} (mOhm) @10V	@4.5V	Q _G typ @V _{GS} = 10V (nC)	Typ. C _{ISS} (pf) @25V _{DSS}	E _{AS} (mJ)	I _{AS} (A)	T _j max	Availability
DMTH3002LPSQ	PowerDI5060	N	30	20	100	1 – 2	2.5	1.5	5000	77	600	20	175	Released
DMTH3004LK3Q	TO252-3L	N	30	20	75	1 – 3	4	7	2370	20	287	10.7	175	Released
DMTH4M90SPSQ	PowerDI5060	N	40	20	100	2 – 4	0.9	-	TBC	TBC	TBC	TBC	175	Q3 2018
DMTH4001SPSQ	PowerDI5060	N	40	20	316	1 – 3	1	-	143	11998	3517	240	175	Q3 2018
DMTH41M8SPSQ	PowerDI5060	N	40	20	204	2 – 4	1.8	-	88	6990	224	67	175	Q3 2018
DMTH4004SPSQ	PowerDI5060	N	40	20	100	2 – 4	2.7	-	60.1	3714	200	45	175	Released
DMTH4003LPSQ	PowerDI5060	N	40	20	149	2 – 4	3	5	26.5	3882	117	48	175	Q3 2018
DMTH4004LK3Q	TO252-3L	N	40	20	100	1 – 3	2.8	4.8	83	4450	120	30	175	Released
DMTH4004SCTBQ	TO263-3L	N	40	20	100	2 – 4	3	-	68.8	4305	200	45	175	Released
DMTH43M8LK3Q	TO252-3L	N	40	20	119	1 – 2.4	3.6	5.2	47	2970	87	13.2	175	Released
DMTH43M8LFGQ	PowerDI3333	N	40	20	119	1 – 2.5	3.6	5.2	38.5	2693	87	13.2	175	Released
DMTH43M8LPSQ	PowerDI5060	N	40	20	115	1 – 2.5	3.6	5.2	38.5	2693	87	13.2	175	Released
DMTH43M8LPDQ	PowerDI5060	N+N	40	20	100	1 – 2.5	3.6	5.2	38.5	2693	87	13.2	175	Q3 2018
DMTH4005SPSQ	PowerDI5060	N	40	20	90	2 – 4	4	-	49.1	3062	52.8	32.5	175	Released
DMTH4005SK3Q	PowerDI5060	N	40	20	90	1 – 4	4.5	-	49.1	3062	52.8	32.5	175	Released
DMTH4007LPSQ	PowerDI5060	N	40	20	100	1 – 3	6.5	9.8	29.1	2492	20	20	175	Released
DMTH4007LK3Q	TO252-3L	N	40	20	70	1 – 3	7.3	9.8	29.1	1895	20	20	175	Released
DMTH4007SPDQ	PowerDI5060	N+N	40	20	18	2 – 4	8.6	-	41.9	2026	89	24	175	Released
DMTH4008LPSQ	PowerDI5060	N	40	20	12	1 – 3	11.5	18	7	1030	32	14	175	Released
DMTH4008LDFWQ	DFN2020-6	N	40	20	12	1 – 3	11.5	18	7	1030	32	14	175	Released
DMTH4011SPDQ	PowerDI3333	N	40	20	55	1 – 3	12	18.5	15	767	238	30	175	Q3 2018
DMTH4014LPDQ	PowerDI5060	N+N	40	20	43.6	1 – 3	15	25	10.2	733	20.5	11.7	175	Q3 2018
DMTH61M8LPSQ	PowerDI5060	N	60	20	100	2 – 4	1.8	-	123.1	10267	354	14	175	Q3 2018
DMTH6002LPSQ	PowerDI5060	N	60	20	100	1 – 3	1.8	3	130.8	6555	294	14	175	Q3 2018
DMTH6004SPSQ	PowerDI5060	N	60	20	90	2 – 4	3.1	-	95.4	4556	200	45	175	Released
DMTH6004SCTBQ	TO263-3L	N	60	20	100	2 – 4	3.4	-	95.4	4556	200	45	175	Released
DMTH6004SK3Q	TO252-3L	N	60	20	95	2 – 4	3.8	-	95.4	4556	200	45	175	Released
DMTH6005LK3Q	TO252-3L	N	60	20	80	1 – 3	5.6	10	47.1	2962	83.2	40.8	175	Released
DMTH6005LPSQ	PowerDI5060	N	60	20	100	1 – 3	5	10	47.1	2962	83.2	40.8	175	Released
DMTH6010LK3Q	TO252-3L	N	60	20	50	1 – 3	8	12	40.2	2615	20	20	175	Released
DMTH6010LPSQ	PowerDI5060	N	60	20	50	1 – 3	8	12	40.2	2615	20	20	175	Released
DMTH6010LPDQ	PowerDI5060	N	60	20	50	1 – 3	8	12	41.3	2615	20	20	175	Released
DMTH6016LPSQ	PowerDI5060	N	60	20	37	1 – 2.5	16	24	8.4	864	11.7	15.3	175	Released
DMTH6016LFVWQ	PowerDI3333	N	60	20	20	1 – 2.5	17	28	8.4	864	11.7	15.3	175	Q3 2018
DMTH6016LSDQ	SO8	N+N	60	20	7.8	1 – 2.5	18	26	8.4	864	11.7	15.3	175	Released
DMTH8012LK3Q	TO252-3L	N	80	20	72	1 – 3	17	21	34	1949	10	11	175	Released
DMTH8012LPSQ	PowerDI5060	N	80	20	72	1 – 3	17	21	34	1949	10	11	175	Released
DMTH10H010SPSQ	PowerDI5060	N	100	20	98	2 – 4	8.5	-	53.7	2592	150	10	175	Q3 2018
DMTH10H015LK3Q	TO252-3L	N	100	20	52.5	2 – 4	15	18@6v	33.3	1871	85	7.5	175	Q3 2018
DMTH10H015LPSQ	PowerDI5060	N	100	20	44	1 – 3	16	18@6v	33.3	1871	85	7.5	175	Q3 2018
DMTH10H030LK3Q	TO252-3L	N	100	20	54	1 – 3	22	30	23	1639	15	12.5	175	Q3 2018
DMTH10H017LPDQ	PowerDI5060	N	100	20	60	2 – 4	17	28	14.4	1968	150	10	175	Q3 2018
DMPH4015SK3Q	TO252-3L	P	-40	20	-45	-1.2 – 2.3	11	15	90	4200	260	-22	175	Released
DMPH4015SPSQ	PowerDI5060	P	-40	20	-50	-1 – 2.5	10	14	42.7	4234	260	-22	175	Released
DMPH4025SFVWQ	PowerDI3333	P	-40	20	-20	-0.8 – 1.8	25	45	33.7	1293	31	25	175	Q3 2018
DMPH6023K3Q	TO252-3L	P	-60	20	-35	-1 – 3	33	40	53	2560	60	-35	175	Released
DMPH6050SK3Q	TO252-3L	P	-60	20	-23.5	-1 – 3	50	70	25	1377	31	-25	175	Released
DMPH6050SSDQ	SO8	P+P	-60	20	-5.2	-1 – 3	50	70	11.9	1293	30.8	24.8	175	Released
DMPH6050SFGQ	PowerDI3333	P	-40	20	4.8	-1 – 3	50	70	11.9	1293	30.8	24.8	175	Released
DMPH6250SQ	SOT23	P	-60	20	5.3	-1 – 3	155	240	4	512	-	-	175	Q3 2018



During the lifetime of a vehicle it is necessary to change a vehicles battery during maintenance or at the end of battery life. There is therefore a risk that the battery could be reconnected in ‘reverse’ causing a damaging ‘short circuit’ to be applied across the Electronic Control Units (ECU’s) in the vehicle.

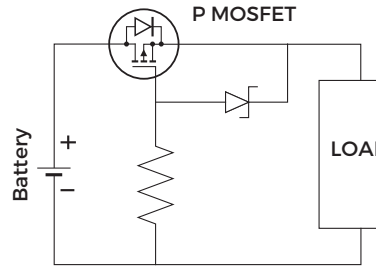
HIGHLIGHTED PRODUCT	
Product	Application
DMTH6004SCTBQ	Reverse Polarity Protection
DMPH4015SK3Q	Reverse Polarity Protection

REVERSE BATTERY PROTECTION

For this reason all automotive ECU’s include a reverse polarity protection scheme. The simplest solution is a diode in series with the power rail but the power losses are relatively high. A more efficient solution is to use either N- or P-channel MOSFET.

Reverse polarity solutions that use P-channel MOSFETs generate lower power losses than those using a diode and can be implemented with a minimal number of passive components. By comparison, reverse polarity protection circuits that use N-channel MOSFETs deliver the lowest power losses but require a charge pump to provide the gate drive voltage, adding complexity, cost and component count.

Furthermore, each ECU has to pass the ISO7637-2 pulse tests so it is essential that the MOSFET is avalanche rated.



MOSFET REQUIREMENTS	
■ Low $R_{DS(ON)}$ – Minimize Conduction Losses	
■ 100% Avalanche Rated – Withstand ISO7637 Pulses	
■ Rated to +175°C – For use in high ambient temperature environments	

CROSS REFERENCE GUIDE

Diodes Part	Fairchild	Infineon	Nexperia	ON Semi	Vishay
DMTH3002LPSQ	-	-	-	NVMFS4C03N	-
DMTH3004LK3Q	FDD8896_F085	IPD50N03S4L-06	BUK9207-30B	NVD4804NT4G	-
DMTH3004LPSQ	-	-	-	-	-
DMTH4001SPSQ	-	IPC100N04S5-1R1	-	-	-
DMTH4003LPSQ	-	-	-	-	-
DMTH4004LK3Q	FDD9409L_F085	-	-	NVD5890NL	SQD100N04-3m6L
DMTH4004SCTBQ	FDB9409_F085	IPB80N04S3-03	BUK763R1-40E	-	SQM100N04-2m7
DMTH4004SPSQ	FDMS9409_F085	IPC100N04S5-2R8	BUK7Y3R0-40H	NVMFS5C450N	-
DMTH4005SK3Q	-	IPD90N04S4-05	BUK625R0-40C	NVD5C460N	SQD50N04-5m6
DMTH4005SPSQ	FDMS9409_F085	IPC90N04S5-3R6	BUK9Y4R4-40E	-	SQJ422EP
DMTH4007LK3Q	FDD9411L_F085	IPD50N04S4L-08	BUK9209-40B	NVD5C478NL	-
DMTH4007LPSQ	FDMS9411_F085	IPG24N04S5L-7R4	-	NTDV5804N	SQJA88EP
DMTH4007SPDQ	-	IPG20N04S4-08	BUK7K8R7-40E	NVMFD5C466N	SQJB40EP
DMTH4008LDFWQ	-	-	-	-	-
DMTH4008LPSQ	-	IPG20N04S4L-11A	BUK9Y14-40B	-	SQJ420EP
DMTH4011SPDQ	-	IPG20N04S4-12	BUK9K18-40E	NVMFD5C478N	SQJ912BEP
DMTH4014LPDQ	-	-	BUK9K25-40E	NVMFD5C478NL	-
DMTH41M8SPSQ	FDMS9408_F085	IPC100N04S5-1R7	BUK7Y1R7-40H	-	-
DMTH43M8LFCQ	-	IPZ40N04S5L-4R8	-	NVTF55C453NL	-
DMTH43M8LPDQ	-	-	-	-	-
DMTH43M8LPSQ	-	IPC90N04S5L-3R3	-	-	SQJ412EP
DMTH4M90SPSQ	-	-	-	NVMFS5C410N	-
DMTH6002LPSQ	-	-	-	NVMFS5C628NL	-
DMTH6004SCTBQ	-	IPB90N06S4-04	BUK763R1-60E	-	SQM120N06-3m5L
DMTH6004SK3Q	FDD86567_F085	IPD90N06S4-04	-	-	-
DMTH6004SPSQ	FDMS86568_F085	-	-	NVMFS5C638NL	-
DMTH6005LK3Q	-	IPD90N06S4L-06	-	-	SQD97N06-6m3L
DMTH6005LPSQ	FDMS5360L_F085	-	-	-	-
DMTH6010LK3Q	-	IPD50N06S4L-08	-	NVD5C668NL	SQD50N06-09L
DMTH6010LPDQ	-	IPG20N06S4L-11	BUK9K13-60E	NVMFD5C672NL	SQJB60EP
DMTH6010LPSQ	FDMS5361L_F085	-	-	NVMFS5C673NL	-
DMTH6016LFWWQ	-	-	BUK9M24-60E	-	SQJ7414CENW
DMTH6016LPSQ	-	IPG20N06S4L-14	BUK9Y25-60E	NVMFS5885NL	-
DMTH6016LSDQ	-	-	-	-	-
DMTH8012LK3Q	-	IPD50N08S4-13	BUK9217-75B	-	-
DMTH8012LPSQ	-	-	-	-	SQJA86EP
DMNH10H028SK3Q	FDD3672_F085	IPD35N10S3L-26	BUK9230-100B	NVD6828NL	SQD40N10-25
DMNH10H028SPSQ	-	IPG20N10S4L-22	BUK9Y22-100B	-	SQJ488EP
DMTH10H010SPSQ	-	-	-	-	-
DMTH10H015LK3Q	-	IPD50N10S3L-16	-	-	SQD70140EL
DMTH10H015LPSQ	-	-	BUK9Y19-100E	-	-
DMTH10H017LPDQ	-	IPG20N10S4L-22	BUK9K29-100E	-	SQJ974EP
DMTH10H030LK3Q	-	IPD30N10S3L-34	-	-	-
DMPH4015SPSQ	-	-	BUK6Y15-40P	-	SQJ415EP
DMPH4015SK3Q	FDD4141_F085	IPD50P04P4L	-	-	SQD40131EL
DMPH4025SFVWQ	-	-	-	-	SQ5401EN
DMPH6023SK3Q	-	-	-	NVAT55A113PLZ	-
DMPH6050SFCQ	-	-	-	NVTF55116PL	-
DMPH6050SK3Q	-	-	-	-	SUD19P06-60L
DMPH6050SSDQ	-	-	-	-	SQ4917EY
DMPH6250SQ	-	-	-	-	SQ2361ES

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