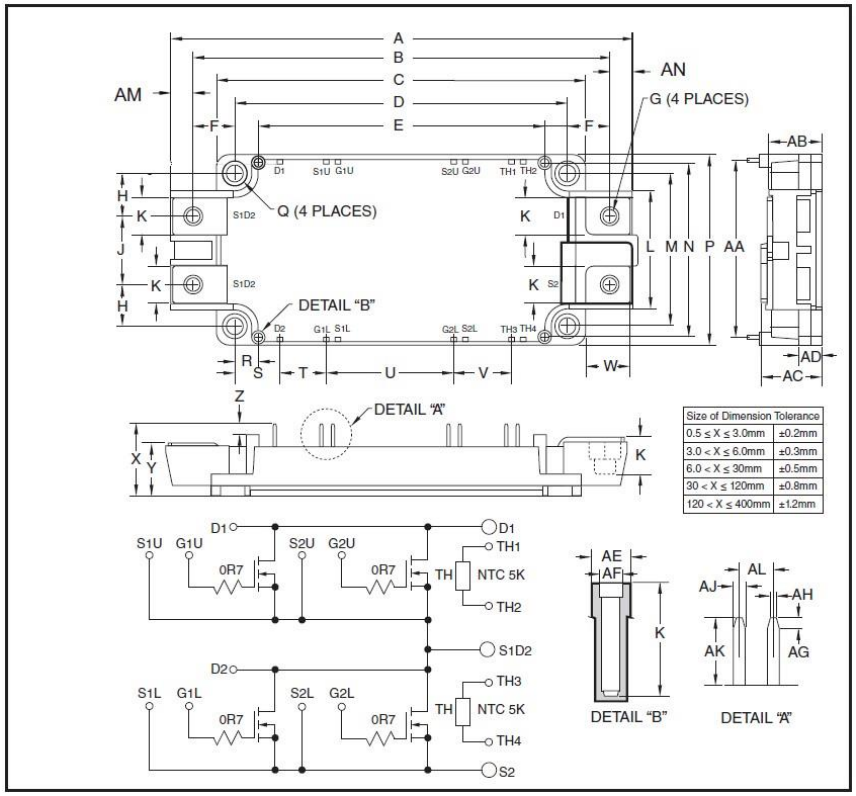
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

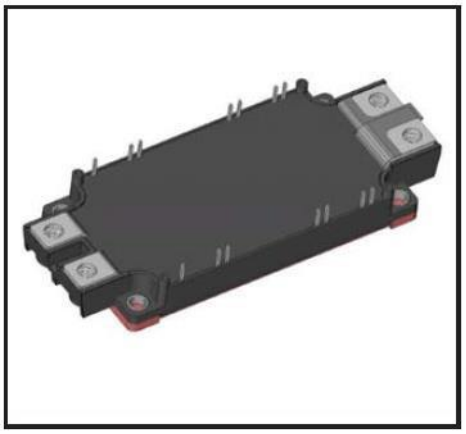
Silicon Carbide Dual MOSFET Module

540 Amperes / 1700 Volts/ 4.8 mΩ



Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters	Dimensions	Inches	Millimeters
A	6.14	156.0	U	165	41.91
B	5.4	137.0	V	0.75	19.05
C	4.8	121.7	W	0.57	14.5
D	4.33	110.0	X	0.96	24.5
E	3.62	94.5	Y	0.71	18.0
F	0.53	13.5	Z	0.13	3.4
G	M6 Metric	M6	AA	2.3	58.4
H	0.55	4.0	AB	0.7	17.5
J	0.86	22.0	AC	0.78	20.0
K	0.47	12.0	AD	0.32	8.0
L	1.53	39.0	AE	0.16 Dia.	4.0 Dia.
M	1.97	50.0	AF	0.1 Dia.	2.5 Dia.
N	2.26	57.5	AG	0.04	1.0
P	2.44	62.0	AH	0.021	0.55
Q	0.21	5.5	AJ	0.045	1.15
R	0.3	7.75	AK	0.04 x 0.03	1.15 x 0.8
S	0.6	15.0	AL	0.15	3.81
T	0.60	15.24	AM	0.32	8.0
			AN	0.43	11.0



Description:
Powerex Dual MOSFET Modules are designed for use in high frequency applications. Each module consists of two SiC-DMOS in half-bridge configuration. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

Features:
- ☐ Low On-Resistance (4.8 mΩ)
- ☐ Ultra-Low Switching Losses
- ☐ High-Frequency Operation
- ☐ Copper Baseplate and Aluminum Nitride Insulator
- ☐ Wolfspeed® 3rd generation SiC

Applications:
- ☐ Solar Inverters, Wind Converters
- ☐ Motor Drives
- ☐ Induction Heating
- ☐ HF Converters
- ☐ UPS
- ☐ Traction Inverters

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QJD1760SB1
Silicon Carbide Dual MOSFET Module
540 Amperes / 1700 Volts

Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	QJD1760SB1	Units
Power Device Junction Temperature	T_j		-40 to 150	°C
V_{GS} Storage Temperature	T_{stg}		-40 to 125	°C
Continuous Drain Current	I_D	V_{GS} = 20V, T_C = 25°C	540	Amperes
		V_{GS} = 20V, T_C = 90°C	375	Amperes
Pulsed Drain Current*1	$I_{D(pulse)}$	T_C = 25°C	1500	Amperes
Power Dissipation	P_{tot}	T_C = 25°C	2780	Watts
Drain Source Breakdown Voltage	$V_{DS(max)}$	V_{GS} = 0V, I_{DS} = 2mA	1700	Volts
Module Inductance, Main Terminals-Chip (Per Switch)	L		4.5	nH
Mounting Torque, M5 Mounting Screws	—		31	in-lb
Mounting Torque, M6 Main Terminal Screws	—		40	in-lb
Module Weight (Typical)	—		500	Grams
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{ISO}		4000	Volts

DC Characteristics, T_j = 25 °C unless otherwise

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain Source Leakage Current	I_{DSS}	V_{DS} = 1700V, V_{GS} = 0V	—	—	4	mA
		T_j = 150°C	—	—	8	mA
Gate Source Leakage Current	I_{GSS}	V_{DS} = 0V , V_{GS} = 20V	—	—	1000	nA
Recommended Gate Source Voltage	V_{GS}		—	-5 / +20	—	Volts
Maximum Gate Source Voltage	$V_{GS(max)}$	V_{DS} = 0V	—	—	-10 / +25	Volts
Gate Source Threshold Voltage	V_{th}	V_{GS} = V_{DS}, I_{DS} = 180mA	2.0	2.4	4.0	Volts
Drain Source On-Resistance	$R_{DS(on)}$	V_{GS} = 20V, I_{DS} = 500A	—	4.8	6.0	mΩ
		T_j = 150°C	—	9.7	12.0	mΩ
Internal Gate Source Series Resistance Per Upper or Lower MOSFET	$R_{gate(esr)}$	V_{GS} = 0V, f = 1MHz, Drain Floating	—	0.4	0.45	Ω

*1 Pulse width limited by $T_{j(max)}$.

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Dynamic Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input Capacitance	C_{ISS}	V_{GS} = 0V, V_{DS} = 1000V, f = 1 MHz	—	36.7	—	nF
Output Capacitance	C_{OSS}		—	1.7	—	nF
Reverse Transfer Capacitance	C_{RSS}		—	0.07	—	nF
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 1200V, V_{GS} = -5 to 20V, I_D = 500A, $R_{G(max)}$ = 0Ω		TBD		ns
Rise Time	t_r			TBD		ns
Turn-Off Delay Time	$t_{d(off)}$			TBD		ns
Fall Time	t_f			TBD		ns
Turn-On Energy	E_{on}	V_{DD} = 1200V, V_{GS} = -5 to 20V, I_D = 540A, R_G = 2.2Ω T_j = 150°C		TBD		mJ
Turn-Off Energy	E_{off}			TBD		mJ
Recovery Energy	E_{rr}			TBD		mJ
Total Gate Charge	Q_G	V_{DD} = 1200V, V_{GS} = -5 to 20V, I_D = 500A, R_G = 2.2Ω, T_j = 25°C		1880		nC

Body Diode, T_j = 25 °C unless otherwise specified*[2]

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Pulsed Body Diode Current	I_S	V_{GS} = -5V	—	—	720*[2]	Amperes
Reverse Recovery Current	I_{rr}	V_{GS} = -5V, I_D = 540A, V_R = 1200V	—	140	—	Amperes
Reverse Recovery Charge	Q_{rr}	T_j = 25°C, di/dt = 1400A/µs	—	5.3	—	µC
Diode Forward Voltage	V_{SD}	V_{GS} = 0V, I_{SD} = 400A	—	4.18	—	Volts
			3.60	—	—	Volts

Thermal Resistance Characteristics

Thermal Resistance, Junction to Case*[3]	$R_{th(j-c)}$	Per MOSFET	—	—	0.045	°C/W
Contact Thermal Resistance*[3]	$R_{th(c-f)}$	Thermal Grease Applied	—	0.015	—	°C/W

NTC Thermistor Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Zero Power Resistance	R_{25}	T_C = 25°C	4.85	5.00	5.15	kΩ
Deviation of Resistance	ΔR/R	T_C = 100°C, R_{100} = 493Ω	-7.3	—	+7.8	%
B Constant	$B_{(25/50)}$	$B_{(25/50)} = \ln(R_{25} / R_{50}) / (1/T_{25} - 1/T_{50})$*[4]	—	3375	—	K
Power Dissipation	P_{25}	T_C = 25°C	—	—	10	mW

*2 Use of body diode is recommended in pulse mode only, with pulse duration up to 1µs.
*3 T_C, T_f measured point is just under the chips.
*4 R_{25}: Resistance at Absolute Temperature T_{25}(K), R_{50}: Resistance at Absolute Temperature T_{50}(K), T_{25} = 25(°C) + 273.15 = 298.15(K), T_{50} = 50(°C) + 273.15 = 323.15(K)

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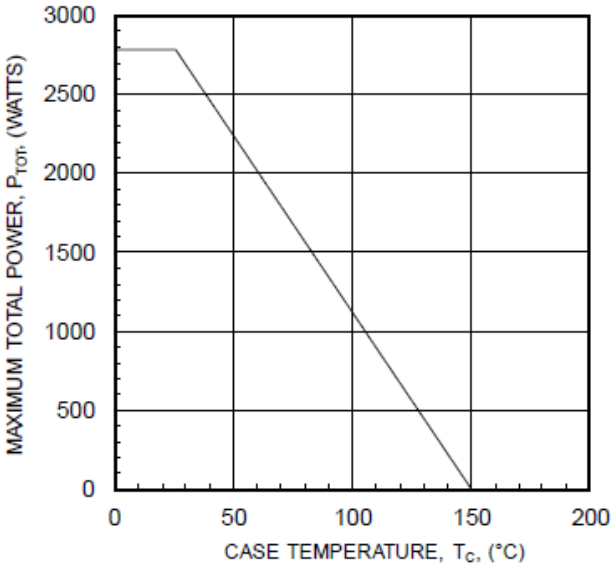
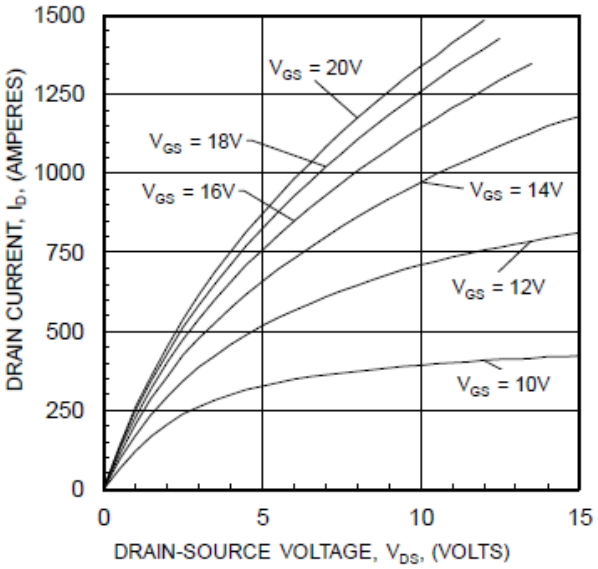
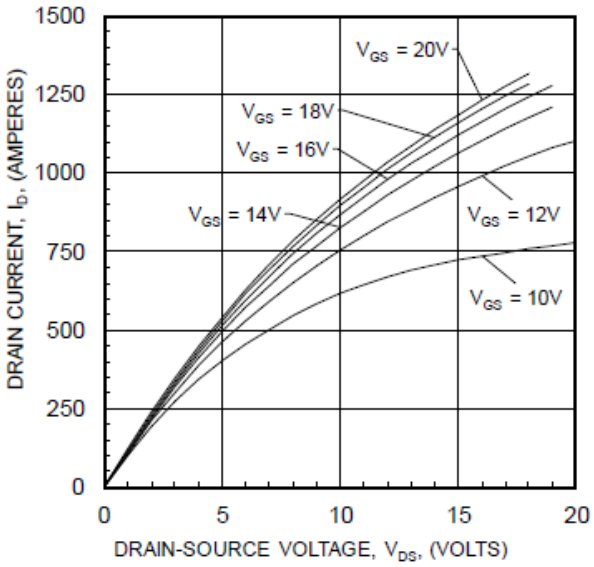
POWER DISSIPATION
$P_{TOT} = f(T_C)$



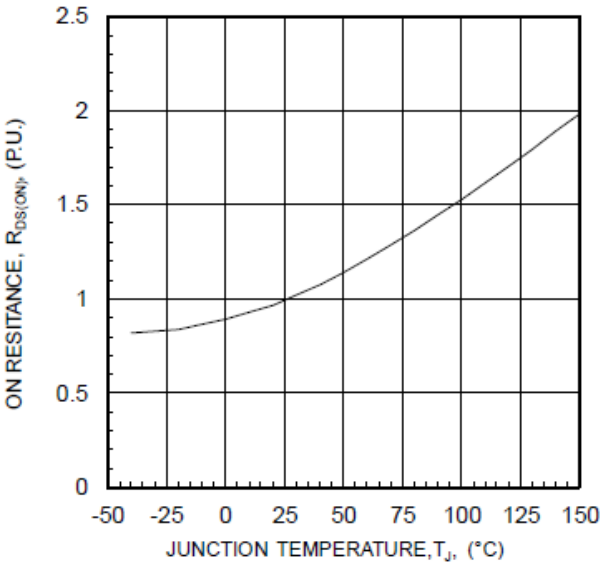
OUTPUT CHARACTERISTICS
$T_j = 25°C, t_P < 200\ \mu s$



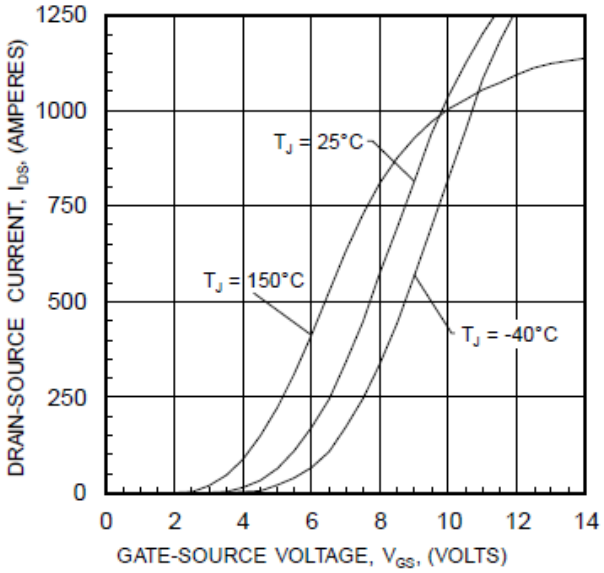
OUTPUT CHARACTERISTICS
$T_j = 150°C, t_P < 200\ \mu s$



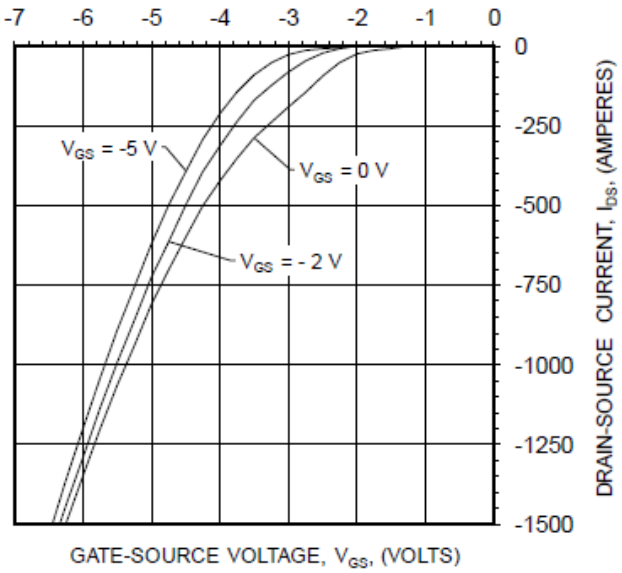
$R_{DS(on)}$ vs TEMPERATURE
$I_{DS} = 500$ A, $V_{GS} = 20$ V, $t_P < 200\ \mu s$



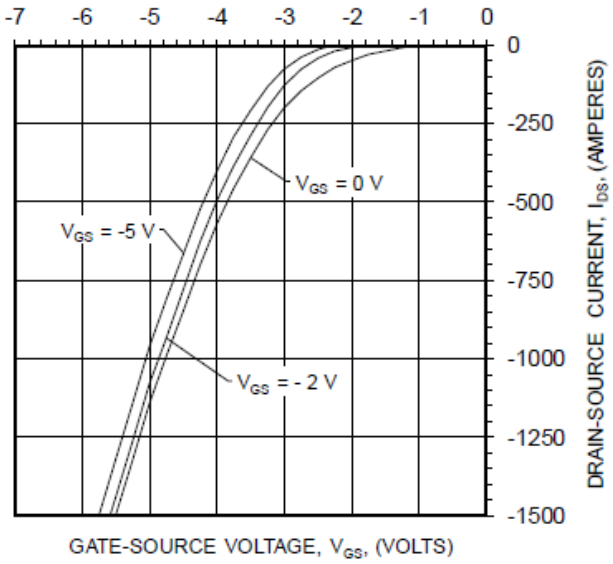
TRANSFER CHARACTERISTICS
V_{DS} = 20 V, t_P< 200 µs



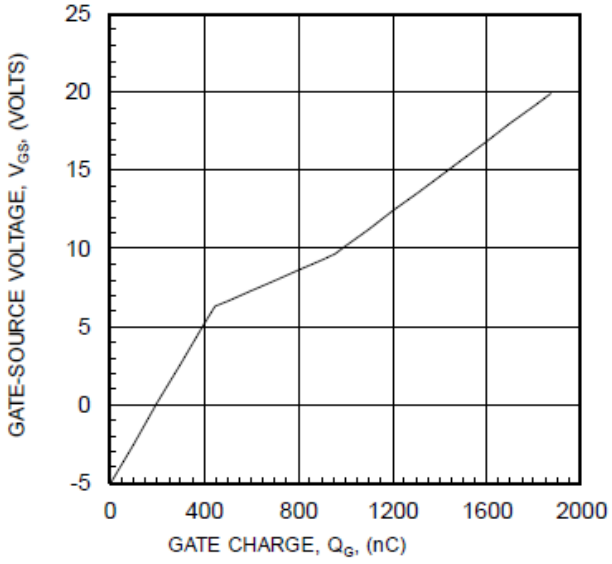
BODY DIODE CHARACTERISTICS
T_J = 25 °C, t_P< 200 µs



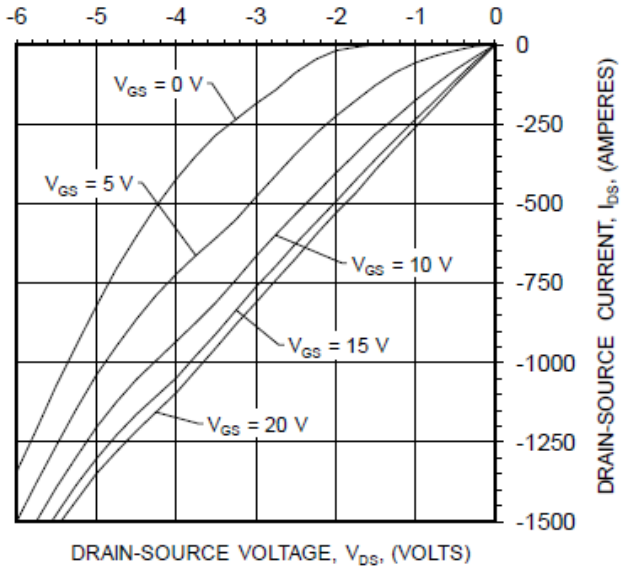
BODY DIODE CHARACTERISTICS
T_J = 150 °C, t_P< 200 µs



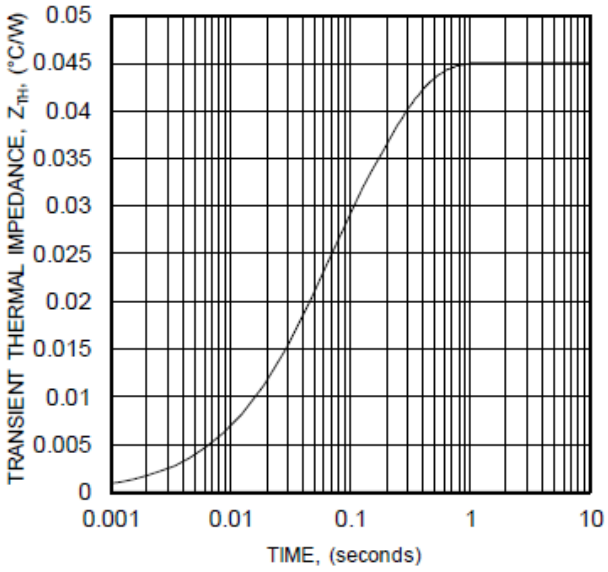
GATE CHARGE
I_{DS} = 500 A, I_{GS} = 100 mA, V_{DS}= 1200 V, T_J = 25°C



3RD QUADRANT CHARACTERISTICS
T_J = 25 °C, t_P< 200 µs



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS



$$Z_{th(j\text{-}c)}(t) = \sum_{i=1}^{n} R_i \left\{1 - \exp\left[\frac{-t}{\tau_i}\right]\right\}$$

	1	2	3	4
R_i	6.87E-05	-2.02E-04	6.35E-03	3.85E-02
τ_i	3.33E-04	1.99E-03	1.05E-02	1.09E-01