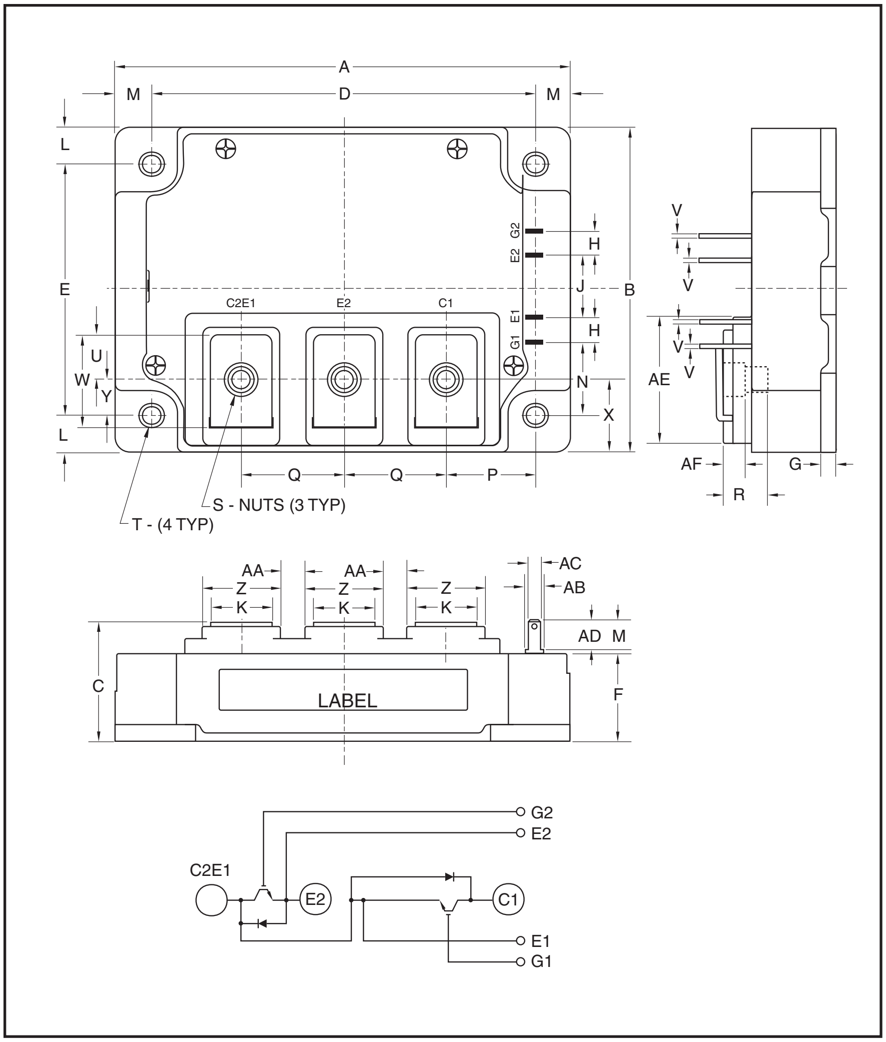
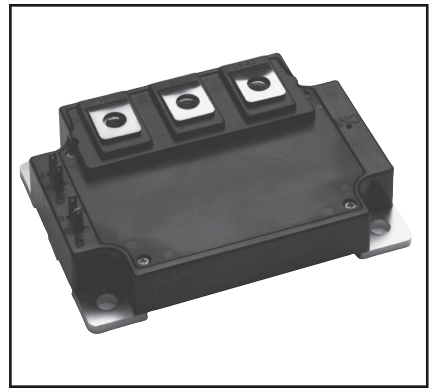
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

Dual IGBTMOD™
NFJ-Series Module
400 Amperes/1200 Volts



Outline Drawing and Circuit Diagram



Dimensions	Inches	Millimeters
A	4.33	110.0
B	3.15	80.0
C	1.14+0.04/-0.01	29.0+1.0/-0.5
D	3.66±0.01	93.0±0.25
E	2.44±0.01	62.0±0.25
F	0.83	21.2
G	0.16	4.0
H	0.24	6.0
J	0.59	15.0
K	0.55	14.0
L	0.35	9.0
M	0.33	8.5
N	0.69	17.5
P	0.85	21.5
Q	0.98	25.0

Dimensions	Inches	Millimeters
R	0.47	12.0
S	M6 Metric	M6
T	0.26 Dia.	6.5 Dia.
U	0.4	10.0
V	0.02	0.5
W	0.87	22.2
X	0.72	18.25
Y	0.36	9.25
Z	0.71	18.0
AA	0.28	7.0
AB	0.16	4.0
AC	0.11	2.8
AD	0.3	7.5
AE	1.23	31.4
AF	0.21	5.3

Description:
Powerex IGBTMOD™ Modules are designed for use in high frequency applications; 30 kHz for hard switching applications and 60 to 70 kHz for soft switching applications. Each module consists of two IGBT Transistors in a half-bridge configuration with each transistor having a reverse-connected super-fast recovery free-wheel diode. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

Features:
- ☐ Low $E_{SW(off)}$
- ☐ Discrete Super-Fast Recovery Free-Wheel Diode
- ☐ Isolated Baseplate for Easy Heat Sinking

Applications:
- ☐ Power Supplies
- ☐ Induction Heating
- ☐ Welders

Ordering Information:
Example: Select the complete part module number you desire from the table below -i.e. CM400DU-24NFJ is a 1200V (V_{CES}), 400 Ampere Dual IGBTMOD™ Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 50)
CM	400	24

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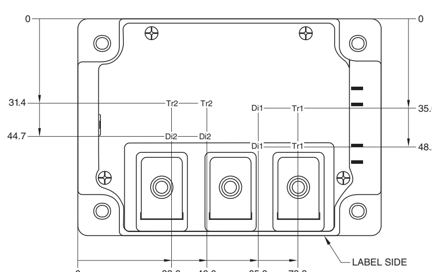
Maximum Ratings, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Rating	Units
Collector-Emitter Voltage (G-E Short)	V_{CES}	1200	Volts
Gate-Emitter Voltage (C-E Short)	V_{GES}	±20	Volts
Collector Current (Operation)*2	I_C	400	Amperes
Collector Current (Pulse)*2	I_{CM}	800	Amperes
Maximum Power Dissipation (T_C = 25°C)*2,*4	P_C	2450	Watts
Emitter Current (Operation)*2	I_E*1	400	Amperes
Emitter Current (Pulse)*2	I_{EM}*1	800	Amperes
Isolation Voltage (Charged Part to Baseplate, f = 60 Hz, AC 1 Minute)	V_{ISO}	2500	V_{rms}
Junction Temperature	T_j	-40 ~ +150	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

Mechanical Characteristics

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Torque Strength	M	Main Terminals, M6 Screw	31	35	40	in-lb
	M	Mounting, M6 Screw	31	35	40	in-lb
Weight			—	580	—	Grams

*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDi).
*2 Pulse width and repetition rate should be such that device junction temperature (T_j) does not exceed $T_{j(max)}$ rating.
*4 Case temperature (T_C) is measured point is just under the chips.



Each mark points to the center position of each chip.
Tr1 / Tr2: IGBT Di1 / Di2: FWDi Tolerance ±1 mm

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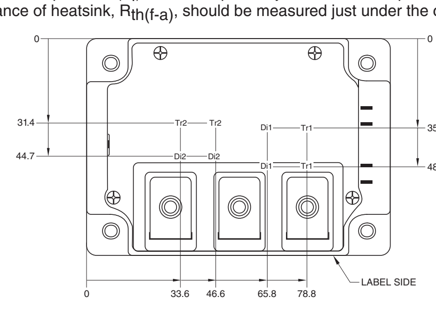
Electrical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	—	—	1.0	mA
Gate Leakage Current	I_{GES}	$\pm V_{GE} = V_{GES}$, V_{CE} = 0V	—	—	1.4	µA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 40mA, V_{CE} = 10V	4.5	6.0	7.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 400A, V_{GE} = 15V, T_j = 25°C*3	—	5.0	6.5	Volts
		I_C = 400A, V_{GE} = 15V, T_j = 125°C*3	—	5.0	—	Volts
Forward Transfer Admittance	$\lvert\gamma_{fs}\rvert$	I_C = 400A, V_{CE} = 10V*3	120	—	—	S
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V	—	—	63	nF
Output Capacitance	C_{oes}		—	—	5.3	nF
Reverse Transfer Capacitance	C_{res}		—	—	1.2	nF
Total Gate Charge	Q_G	V_{CC} = 600V, I_C = 400A, V_{GE} = 15V	—	1800	—	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 400A, V_{GE} = ±15V, R_G = 0.78Ω, Inductive Load, I_E = 400A	—	—	300	ns
Turn-on Rise Time	t_r		—	—	100	ns
Turn-off Delay Time	$t_{d(off)}$		—	—	500	ns
Turn-off Fall Time	t_f		—	—	150	ns
Reverse Recovery Time	t_{rr}*1		—	—	100	ns
Reverse Recovery Charge	Q_{rr}*1		—	7.0	—	µC
Emitter-Collector Voltage	V_{EC}*1	I_E = 400A, V_{GE} = 0V*3	—	5.5	7.0	Volts
Internal Gate Resistance	R_{Gint}	T_c = 25°C, Per Switch	—	3.0	—	Ω
External Gate Resistance	R_G		0.78	—	7.8	Ω

Thermal Resistance Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case	$R_{th(j-c)}Q$	Per IGBT Part*4	—	—	0.051	K/W
Thermal Resistance, Junction to Case	$R_{th(j-c)}D$	Per FWDi Part*4	—	—	0.093	K/W
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Heatsink, Thermal Grease Applied*4*5	—	0.02	—	K/W

*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDi).
*3 Pulse width and repetition rate should be such as to cause negligible temperature rise.
*4 Case temperature (T_C) and heatsink temperature (T_f) measured point is just under the chips.
If using this value, thermal resistance of heatsink, $R_{th(f-a)}$, should be measured just under the chips.



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Tr1 / Tr2: IGBT Di1 / Di2: FWDi Tolerance ±1 mm

*5 Typical value is measured by using thermally conductive grease of λ = 0.9 [W/(m • K)].

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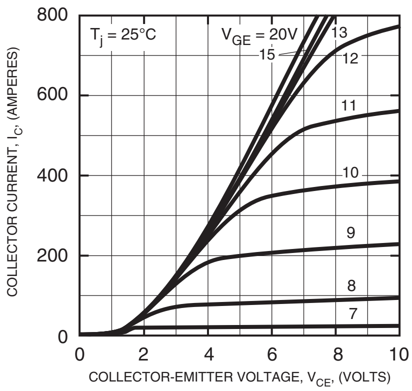
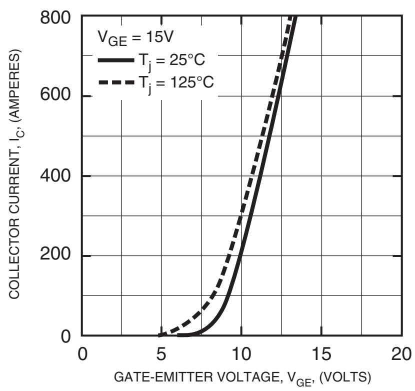
OUTPUT CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



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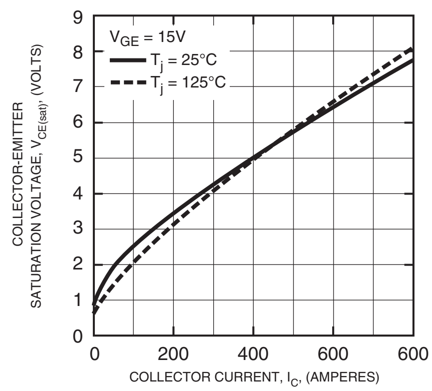
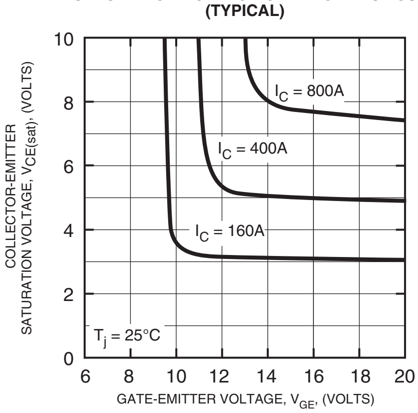
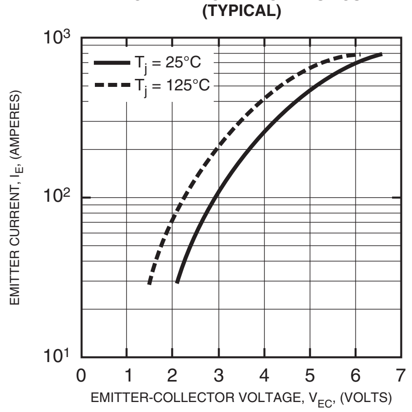


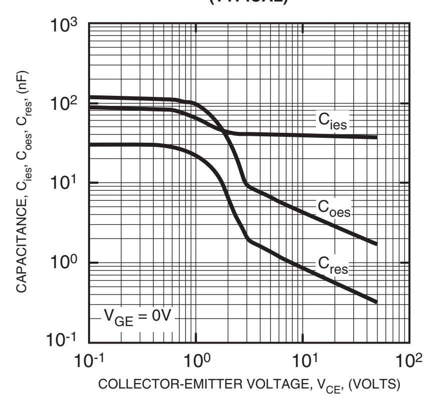
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



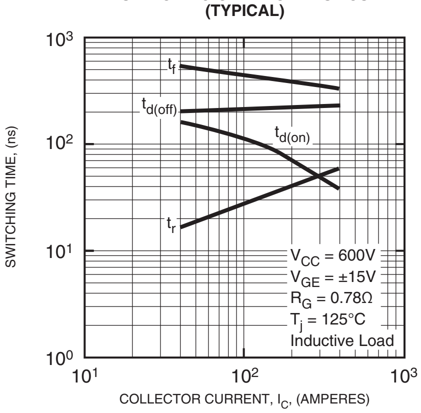
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



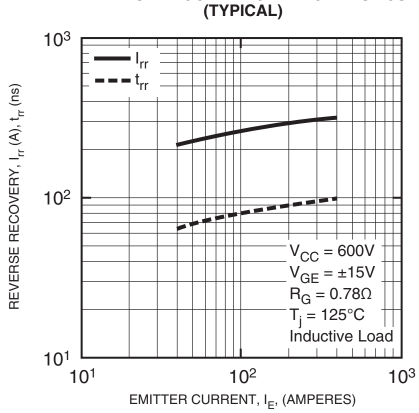
CAPACITANCE VS. V_{CE} (TYPICAL)



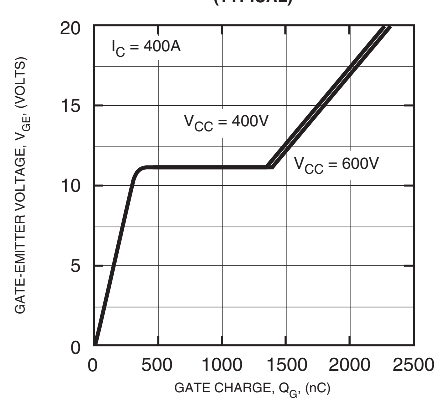
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



GATE CHARGE VS. V_{GE} (TYPICAL)



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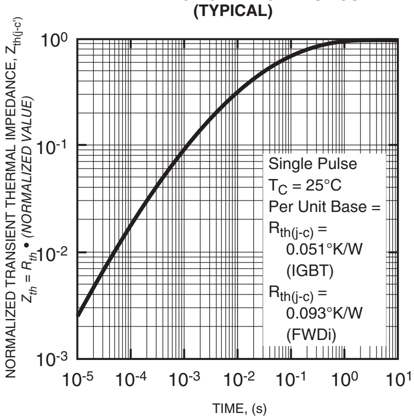
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (TYPICAL)



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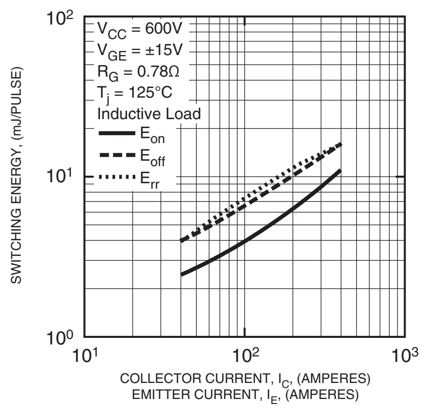

HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)