CM450DX-24S

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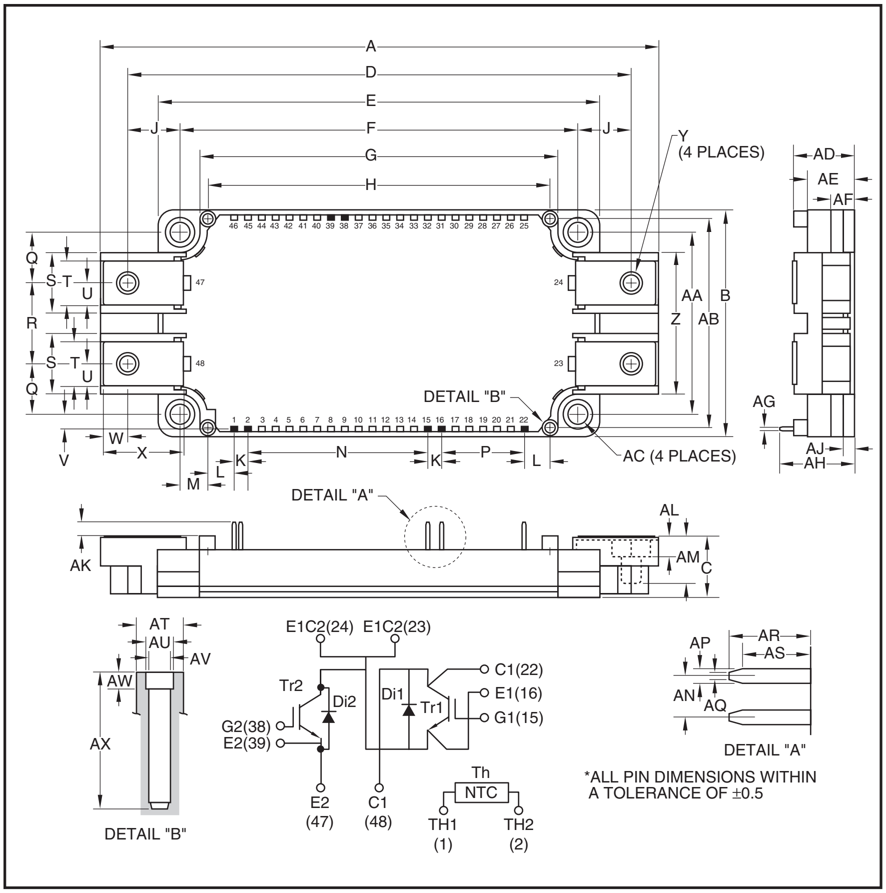
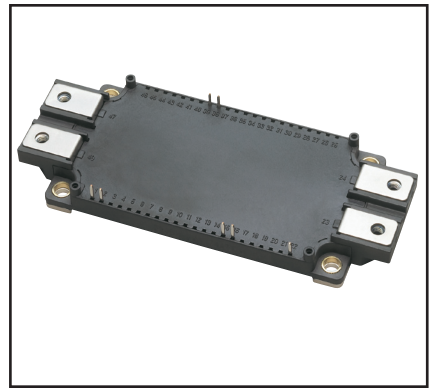
Dual IGBTMOD™
NX-S Series Module
450 Amperes/1200 Volts





Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	5.98	152.0
B	2.44	62.0
C	0.67	17.0
D	5.39	137.0
E	4.79	121.7
F	4.33±0.02	110.0±0.5
G	3.89	99.0
H	3.72	94.5
J	0.53	13.5
K	0.15	3.8
L	0.28	7.25
M	0.30	7.75
N	1.95	49.54
P	0.9	22.86
Q	0.55	14.0
R	0.87	22.0
S	0.67	17.0
T	0.48	12.0
U	0.24	6.0
V	0.16	4.2
W	0.37	6.5
X	0.83	21.14
Y	M6	M6

Dimensions	Inches	Millimeters
Z	1.53	39.0
AA	1.97±0.02	50.0±0.5
AB	2.26	57.5
AC	0.22 Dia.	5.5 Dia.
AD	0.67+0.04/-0.02	17.0+1.0/-0.5
AE	0.51	13.0
AF	0.27	7.0
AG	0.03	0.8
AH	0.81	20.5
AJ	0.12	3.0
AK	0.14	3.5
AL	0.21	5.4
AM	0.49	12.5
AN	0.15	3.81
AP	0.05	1.15
AQ	0.025	0.65
AR	0.29	7.4
AS	0.24	6.2
AT	0.17 Dia.	4.3 Dia.
AU	0.10 Dia.	2.5 Dia.
AV	0.08 Dia.	2.1 Dia.
AW	0.06	1.5
AX	0.49	12.5

Description:
Powerex IGBTMOD™ Modules are designed for use in 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 Drive Power
- ☐ Low $V_{CE(sat)}$
- ☐ Discrete Super-Fast Recovery Free-Wheel Diode
- ☐ Isolated Baseplate for Easy Heat Sinking

Applications:
- ☐ AC Motor Control
- ☐ Motion/Servo Control
- ☐ Photovoltaic/Fuel Cell

Ordering Information:
Example: Select the complete module number you desire from the table below -i.e. CM450DX-24S is a 1200V (V_{CES}), 450 Ampere Dual IGBTMOD™ Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 50)
CM	450	24

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450 Amperes/1200 Volts

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

Characteristics	Symbol	CM450DX-24S	Units
Maximum Junction Temperature	$T_{j(max)}$	+175	°C
Operating Power Device Junction Temperature	$T_{j(op)}$	-40 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Mounting Torque, M5 Mounting Screws	—	31	in-lb
Mounting Torque, M6 Main Terminal Screws	—	40	in-lb
Module Weight (Typical)	—	330	Grams
Isolation Voltage (Terminals to Baseplate, f = 60Hz, AC 1 minute)	V_{ISO}	2500	V_{rms}

Inverter Sector

Collector-Emitter Voltage (V_{GE} = 0V)	V_{CES}	1200	Volts
Gate-Emitter Voltage (V_{CE} = 0V)	V_{GES}	±20	Volts
Collector Current (DC, T_C = 119°C)[*1,*5]	I_C	450	Amperes
Collector Current (Pulse)[*4]	I_{CRM}	900	Amperes
Total Power Dissipation (T_C = 25°C)[*1,*5]	P_{tot}	3400	Watts
Emitter Current, Free Wheeling Diode Forward Current (T_C = 25°C)[*1,*5]	I_E[*3]	450	Amperes
Emitter Current, Free Wheeling Diode Forward Current (Pulse)[*4]	I_{ERM}[*3]	900	Amperes

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

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Inverter Sector

Characteristics		Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector Cutoff Current		I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V	—	—	1	mA
Gate Leakage Current		I_{GES}	$\pm V_{GE} = V_{GES}$, V_{CE} = 0V	—	—	0.5	µA
Gate-Emitter Threshold Voltage		$V_{GE(th)}$	I_C = 45mA, V_{CE} = 10V	5.4	6	6.6	Volts
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$ (Chip)	I_C = 450A, V_{GE} = 15V, T_j = 25°C	—	1.7	2.15	Volts
			I_C = 450A, V_{GE} = 15V, T_j = 125°C	—	1.9	—	Volts
			I_C = 450A, V_{GE} = 15V, T_j = 150°C	—	1.95	—	Volts
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$ (Terminal)	I_C = 450A, V_{GE} = 15V, T_j = 25°C*6	—	1.95	2.4	Volts
			I_C = 450A, V_{GE} = 15V, T_j = 125°C*6	—	2.15	—	Volts
			I_C = 450A, V_{GE} = 15V, T_j = 150°C*6	—	2.2	—	Volts
Input Capacitance		C_{ies}	V_{GE} = 0V, V_{CE} = 10V	—	—	45	nF
Output Capacitance		C_{oes}		—	—	9.0	nF
Reverse Transfer Capacitance		C_{res}		—	—	0.75	nF
Total Gate Charge		Q_G	V_{CC} = 600V, I_C = 450A, V_{GE} = 15V	—	1050	—	nC
Inductive	Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 450A, *7	—	—	800	ns
Load	Turn-on Rise Time	t_r	V_{GE} = ±15V,	—	—	200	ns
Switch	Turn-off Delay Time	$t_{d(off)}$	R_G = 1.6Ω, Inductive Load,	—	—	600	ns
Time	Turn-off Fall Time	t_f	I_E = 450A	—	—	300	ns
Reverse Recovery Time		t_{rr}*3		—	—	300	ns
Reverse Recovery Charge		Q_{rr}*3		—	24	—	µC
Turn-on Switching Loss per Pulse		E_{on}	V_{CC} = 600V, I_C (I_E) = 450A, *7	—	55	—	mJ
Turn-off Switching Loss per Pulse		E_{off}	V_{GE} = ±15V, R_G = 1.6Ω,	—	48	—	mJ
Reverse Recovery Loss per Pulse		E_{rec}*3	T_j = 150°C, Inductive Load	—	27	—	mJ
Emitter-Collector Voltage		V_{EC}*3 (Chip)	I_E = 450A, V_{GE} = 0V, T_j = 25°C	—	1.7	2.15	Volts
			I_E = 450A, V_{GE} = 0V, T_j = 125°C	—	1.7	—	Volts
			I_E = 450A, V_{GE} = 0V, T_j = 150°C	—	1.7	—	Volts
Emitter-Collector Voltage		V_{EC}*3 (Terminal)	I_E = 450A, V_{GE} = 0V, T_j = 25°C*6	—	1.95	2.4	Volts
			I_E = 450A, V_{GE} = 0V, T_j = 125°C*6	—	1.95	—	Volts
			I_E = 450A, V_{GE} = 0V, T_j = 150°C*6	—	1.95	—	Volts

Thermal and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case*1	$R_{th(j-c)}Q$	Per IGBT	—	—	0.044	K/W
Thermal Resistance, Junction to Case*1	$R_{th(j-c)}D$	Per FWDi	—	—	0.78	K/W
Internal Gate Resistance	r_g	Per Switch	—	4.3	—	Ω

*1 Case temperature (T_C) and heatsink temperature (T_f) measured point is just under the chips.
*3 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDi).
*6 Pulse width and repetition rate should be such as to cause negligible temperature rise.
*7 Recommended maximum collector supply voltage V_{CC} is 800V_{dc}.

NTC Thermistor Sector, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Zero Power Resistance	R	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	$B_{(25/50)}$	Approximate by Equation*9	—	3375	—	K
Power Dissipation	P_{25}	T_C = 25°C	—	—	10	mW

Module, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Lead Resistance (Main Terminals-Chip)	R_{lead}	T_C = 25°C (Per Switch)	—	—	0.7	mΩ
Contact Thermal Resistance*1 (Case to Heatsink)	$R_{th(c-f)}$	Thermal Grease Applied (Per 1 Module)*2	—	0.015	—	K/W

*1 Case temperature (T_C) and heatsink temperature (T_f) measured point is just under the chips.
*2 Typical value is measured by using thermally conductive grease of λ = 0.9 [W/(m • K)].
*9 $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$ 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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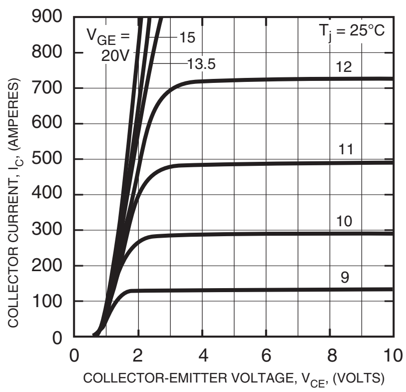
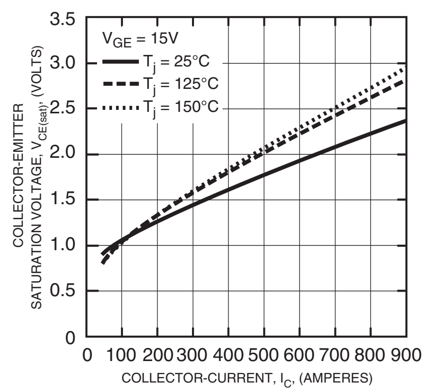
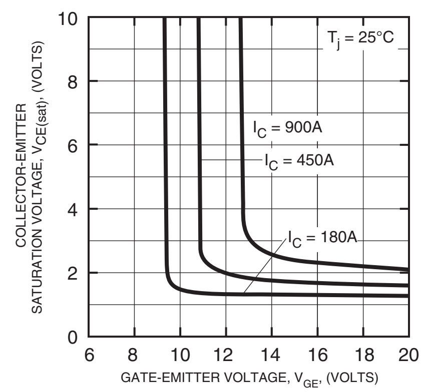
OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)



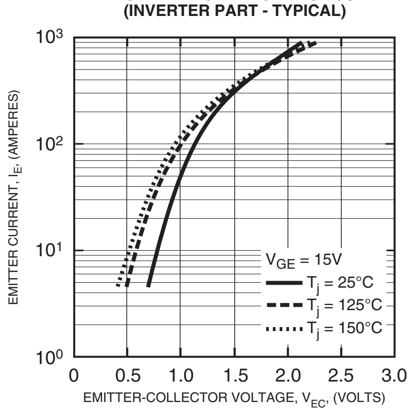
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



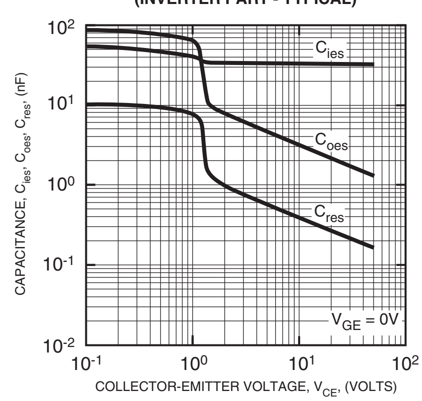
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



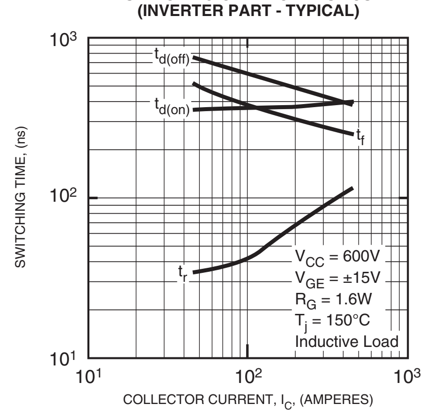
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (INVERTER PART - TYPICAL)



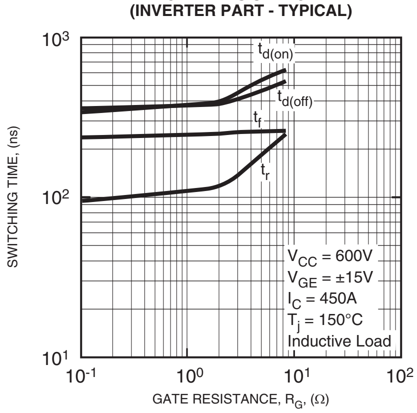
CAPACITANCE VS. V_{CE} (INVERTER PART - TYPICAL)



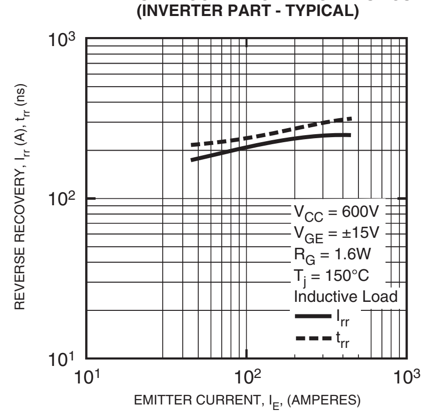
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



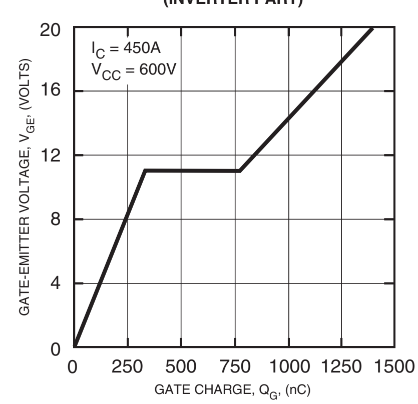
SWITCHING TIME VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)



GATE CHARGE VS. V_{GE} (INVERTER PART)



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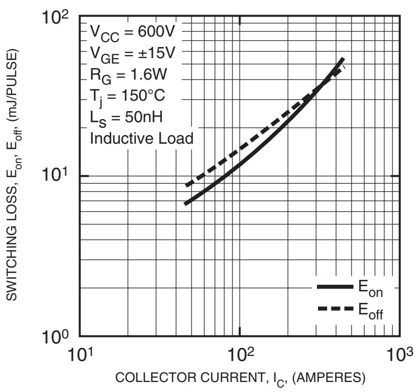
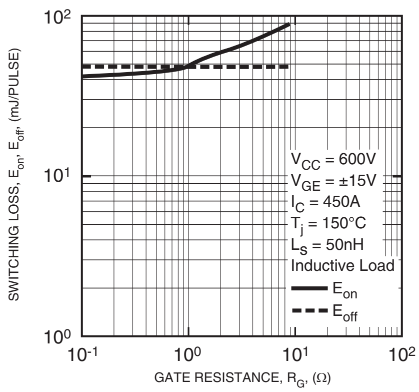
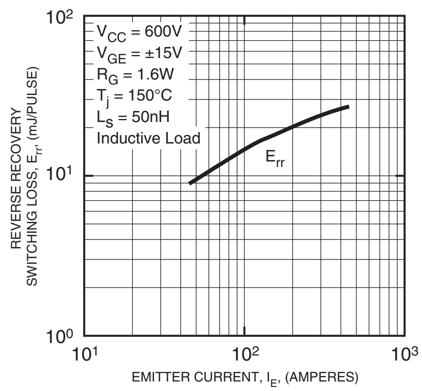
SWITCHING LOSS VS. COLLECTOR CURRENT (INVERTER PART - TYPICAL)



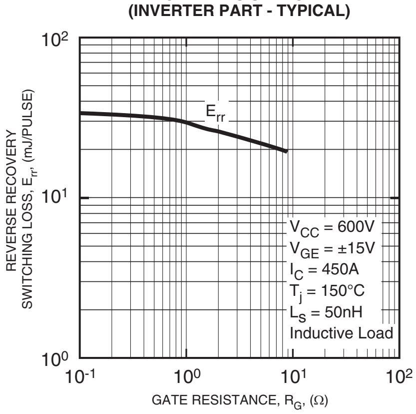
SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



REVERSE RECOVERY SWITCHING LOSS VS. EMITTER CURRENT (INVERTER PART - TYPICAL)



REVERSE RECOVERY SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (INVERTER PART - TYPICAL)