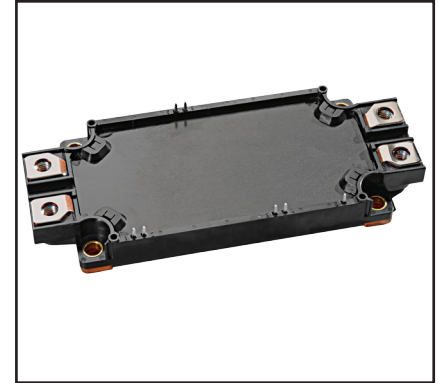
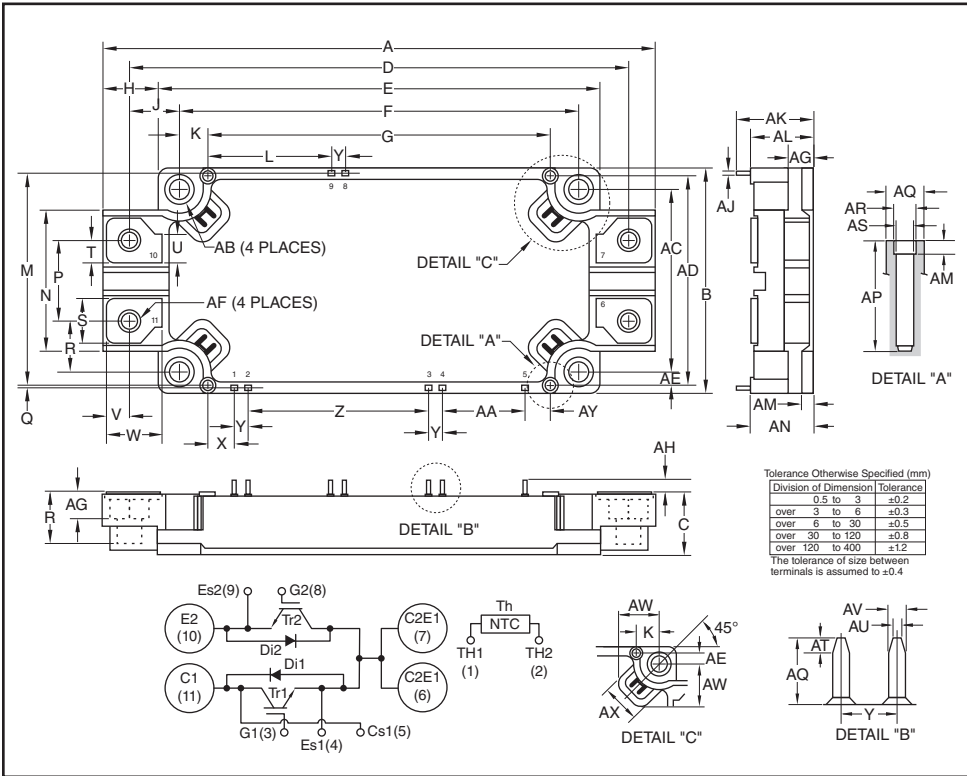


Dual IGBT
NX-Series Module
450 Amperes/1700 Volts



Description:

Powerex IGBT 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-34SA is a 1700V (V_{CES}), 450 Ampere Dual IGBT Power Module.

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	5.98	152.0
B	2.44	62.0
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	5.39	137.0
E	4.79	121.7
F	4.33±0.02	110.0±0.5
G	3.72	94.5
H	0.60	15.14
J	0.53	13.5
K	0.31	7.75
L	1.33±0.012	33.91±0.3
M	2.28±0.012	57.95±0.3
N	1.54	39.0
P	0.87	22.0
Q	0.017±0.012	0.45±0.3
R	0.55	14.0
S	0.47	12.0
T	0.24	6.0
U	0.31	8.0
V	0.26	6.5
W	0.62	15.64
X	0.28±0.012	7.24±0.3
Y	0.15	3.81
Z	1.95±0.012	49.53±0.3

Dimensions	Inches	Millimeters
AA	0.9±0.012	22.86±0.3
AB	0.22 Dia.	5.5 Dia.
AC	1.97±0.02	50.0±0.5
AD	2.26	57.5
AE	0.15	3.75
AF	M6	M6
AG	0.28	7.0
AH	0.14	3.5
AJ	0.03	0.8
AK	0.81	20.5
AL	0.70	17.0
AM	0.12	3.0
AN	0.65	16.5
AP	0.49	12.5
AQ	0.18	4.5
AR	0.102 Dia.	2.6 Dia.
AS	0.089 Dia.	2.25 Dia.
AT	0.05	1.2
AU	0.03	0.65
AV	0.05	1.15
AW	0.54	13.7
AX	0.52	13.0
AY	0.285	7.25

Division of Dimension	Tolerance (mm)
0.5 to 3	±0.2
over 3 to 6	±0.3
over 6 to 30	±0.5
over 30 to 120	±0.8
over 120 to 400	±1.2

The tolerance of size between terminals is assumed to ±0.4

CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

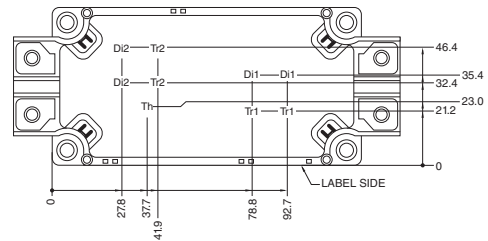
Characteristics	Symbol	Rating	Units
Collector-Emitter Voltage ($V_{GE} = 0\text{V}$)	V_{CES}	1700	Volts
Gate-Emitter Voltage ($V_{CE} = 0\text{V}$)	V_{GES}	± 20	Volts
Collector Current (DC, $T_C = 125^\circ\text{C}$) ^{*2}	I_C	300	Amperes
Collector Current (Pulse) ^{*3}	I_C	450	Amperes
Collector Current ($V_{GE} = 15\text{V}$, Pulse, Repetitive) ^{*3}	I_{CRM}	900	Amperes
Total Power Dissipation ($T_C = 25^\circ\text{C}$) ^{*2,*4}	P_{tot}	3000	Watts
Emitter Current ($T_C = 25^\circ\text{C}$) ^{*2,*4}	I_E^{*1}	300	Amperes
Emitter Current (Pulse) ^{*3}	I_E^{*1}	450	Amperes
Emitter Current (Pulse, $T_C = 25^\circ\text{C}$) ^{*2,*4}	I_{ERM}^{*1}	900	Amperes
Maximum Junction Temperature	$T_{j(max)}$	175	$^\circ\text{C}$
Maximum Case Temperature ^{*2}	$T_{C(max)}$	125	$^\circ\text{C}$
Operating Junction Temperature	$T_{j(op)}$	-40 to +150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +125	$^\circ\text{C}$
Isolation Voltage (Terminals to Baseplate, RMS, $f = 60\text{Hz}$, AC 1 minute)	V_{ISO}	4000	Volts

*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDI).

*2 Case temperature (T_C) and heatsink temperature (T_s) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.

*3 Pulse width and repetition rate should be such that device junction temperature (T_j) does not exceed $T_{j(max)}$ rating.

*4 Junction temperature (T_j) should not increase beyond maximum junction temperature ($T_{j(max)}$) rating.



Tr1, Tr2: IGBT, Di1, Di2: FWDI, Th: NTC Thermistor
 Each mark points to the center position of each chip.

CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

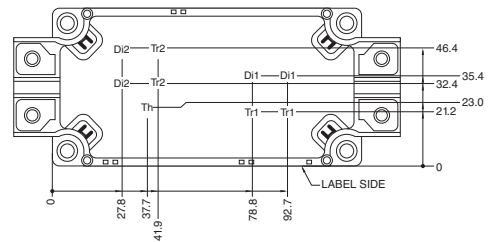
Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = V_{CES}, V_{GE} = 0V$	—	—	1	mA
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = V_{GES}, V_{CE} = 0V$	—	—	0.5	μA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 45\text{mA}, V_{CE} = 10V$	5.4	6.0	6.6	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$ (Terminal)	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^{*5}$	—	2.4	3.05	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 125^\circ\text{C}^{*5}$	—	2.9	—	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}^{*5}$	—	3.0	—	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$ (Chip)	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^{*5}$	—	2.25	2.9	Volts
Input Capacitance	C_{ies}		—	—	79	nF
Output Capacitance	C_{oes}	$V_{CE} = 10V, V_{GE} = 0V$	—	—	8	nF
Reverse Transfer Capacitance	C_{res}		—	—	1.36	nF
Gate Charge	Q_G	$V_{CC} = 1000V, I_C = 450\text{A}, V_{GE} = 15V$	—	1656	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	300	600	ns
Rise Time	t_r	$V_{CC} = 1000V, I_C = 450\text{A}, V_{GE} = \pm 15V,$	—	120	240	ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 1.2\Omega, \text{Inductive Load}$	—	350	700	ns
Fall Time	t_f		—	120	240	ns
Emitter-Collector Voltage	V_{EC}^{*1} (Terminal)	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^{*5}$	—	5.05	6.25	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 125^\circ\text{C}^{*5}$	—	3.8	—	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 150^\circ\text{C}^{*5}$	—	3.6	—	Volts
Emitter-Collector Voltage	V_{EC}^{*1} (Chip)	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^{*5}$	—	4.90	6.10	Volts
Reverse Recovery Time	t_{rr}^{*1}	$V_{CC} = 1000V, I_E = 450\text{A}, V_{GE} = \pm 15V$	—	100	200	ns
Reverse Recovery Charge	Q_{rr}^{*1}	$R_G = 1.2\Omega, \text{Inductive Load}$	—	90	—	μC
Turn-on Switching Energy per Pulse	E_{on}	$V_{CC} = 1000V, I_C = I_E = 450\text{A},$	—	80	—	mJ
Turn-off Switching Energy per Pulse	E_{off}	$V_{GE} = \pm 15V, R_G = 1.2\Omega,$	—	98	—	mJ
Reverse Recovery Energy per Pulse	E_{rr}^{*1}	$T_j = 150^\circ\text{C}, \text{Inductive Load}$	—	61	—	mJ
Internal Lead Resistance	$R_{CC}^{*1} + EE^{*1}$	Main Terminals-Chip, Per Switch, $T_C = 25^\circ\text{C}^{*2}$	—	—	2.0	m Ω
Internal Gate Resistance	r_g	Per Switch	—	1.7	—	Ω

*1 Represent ratings and characteristics of the anti-parallel, emitter-to-collector free wheeling diode (FWDI).

*2 Case temperature (T_C) and heatsink temperature (T_S) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location.

The heatsink thermal resistance should be measured just under the chips.

*5 Pulse width and repetition rate should be such as to cause negligible temperature rise.



Tr1, Tr2: IGBT, Di1, Di2: FWDI, Th: NTC Thermistor
 Each mark points to the center position of each chip.

CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified (continued)

NTC Thermistor Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Zero Power Resistance	R_{25}	$T_C = 25^\circ\text{C}^{*2}$	4.85	5.00	5.15	k Ω
Deviation of Resistance	$\Delta R/R$	$T_C = 100^\circ\text{C}$, $R_{100} = 493\Omega$	-7.3	—	+7.8	%
B Constant	$B_{(25/50)}$	Approximate by Equation ^{*6}	—	3375	—	K
Power Dissipation	P_{25}	$T_C = 25^\circ\text{C}^{*2}$	—	—	10	mW

Thermal Resistance Characteristics

Thermal Resistance, Junction to Case ^{*2}	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case ^{*2}	$R_{th(j-c)Q}$	Per Inverter IGBT	—	—	0.05	K/W
Thermal Resistance, Junction to Case ^{*2}	$R_{th(j-c)D}$	Per Inverter FWDi	—	—	0.08	K/W
Contact Thermal Resistance, Case to Heatsink ^{*2}	$R_{th(c-f)}$	Thermal Grease Applied (Per 1 Module) ^{*7}	—	15	—	K/kW

Mechanical Characteristics

Mounting Torque	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Mounting Torque	M_t	Mounting to Heatsink, M6 Screw	31	35	40	in-lb
Mounting Torque	M_s	Mounting to Heatsink, M5 Screw	22	27	31	in-lb
Creepage Distance	d_s	Terminal to Terminal	17.0	—	—	mm
		Terminal to Baseplate	10.0	—	—	mm
Clearance	d_a	Terminal to Terminal	17.5	—	—	mm
		Terminal to Baseplate	10.0	—	—	mm
Weight	m		—	330	—	Grams
Flatness of Baseplate	e_c	On Centerline X, Y ^{*8}	± 0	—	+100	μm

Recommended Operating Conditions, $T_a = 25^\circ\text{C}$

(DC) Supply Voltage	Symbol	Test Conditions	Min.	Typ.	Max.	Units
(DC) Supply Voltage	V_{CC}	Applied Across C1-E2	—	1000	1200	Volts
Gate (-Emitter Drive) Voltage	$V_{GE(on)}$	Applied Across G1-Es1 / G2-Es2	14.0	15.0	16.5	Volts
External Gate Resistance	R_G	Per Switch	1.2	—	27	Ω

^{*2} Case temperature (T_C) and heatsink temperature (T_S) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.

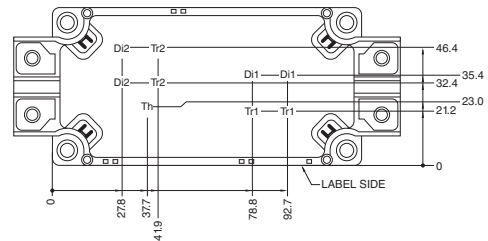
^{*6} $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

R_{25} ; Resistance at Absolute Temperature T_{25} [K]; $T_{25} = 25 [^\circ\text{C}] + 273.15 = 298.15$ [K]

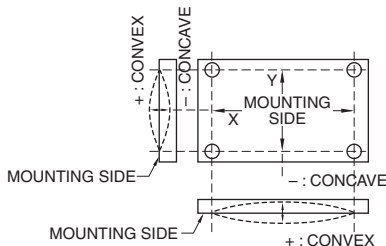
R_{50} ; Resistance at Absolute Temperature T_{50} [K]; $T_{50} = 50 [^\circ\text{C}] + 273.15 = 323.15$ [K]

^{*7} Typical value is measured by using thermally conductive grease of $\lambda = 0.9$ [W/(m • K)].

^{*8} Baseplate (mounting side) flatness measurement points (X, Y) are shown in the figure below.

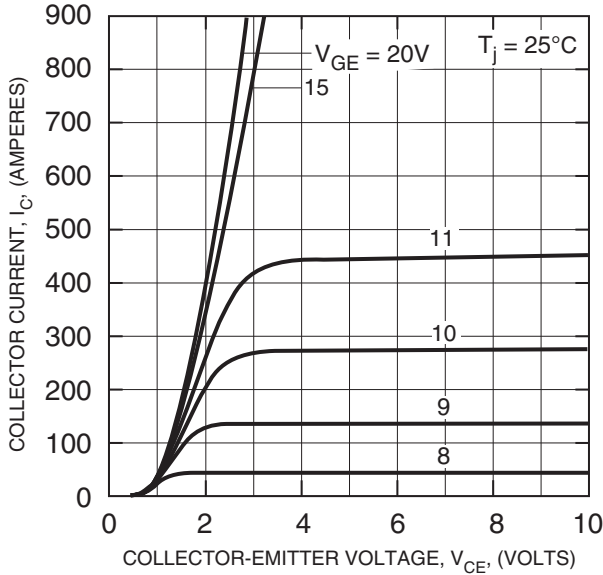


Tr1, Tr2: IGBT, D1, D2: FWDi, Th: NTC Thermistor
 Each mark points to the center position of each chip.

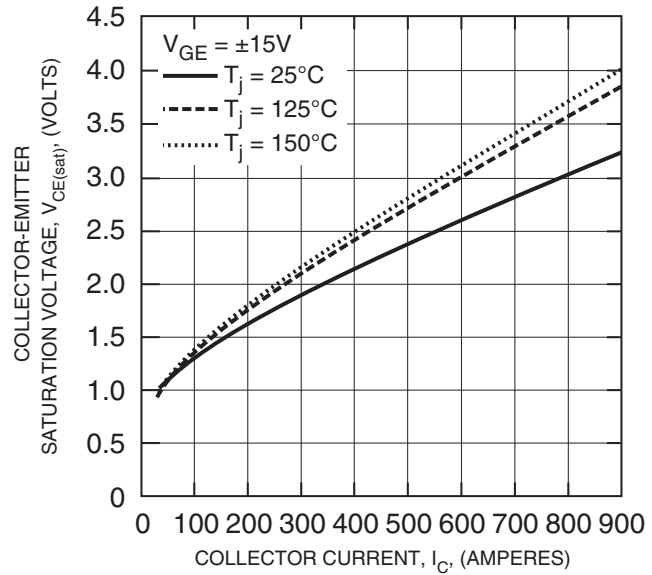


CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

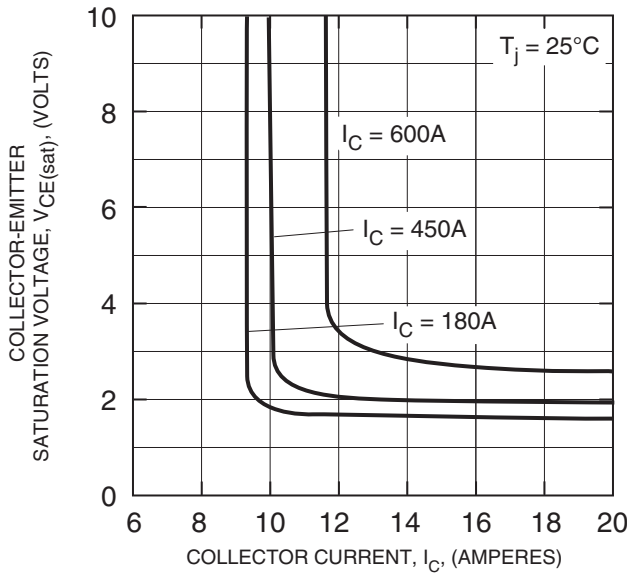
**OUTPUT CHARACTERISTICS
 (INVERTER PART - TYPICAL)**



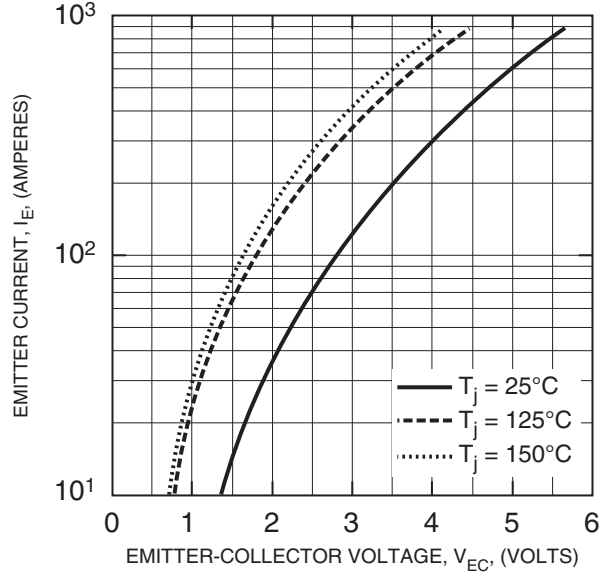
**COLLECTOR-EMITTER
 SATURATION VOLTAGE CHARACTERISTICS
 (INVERTER PART - TYPICAL)**



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

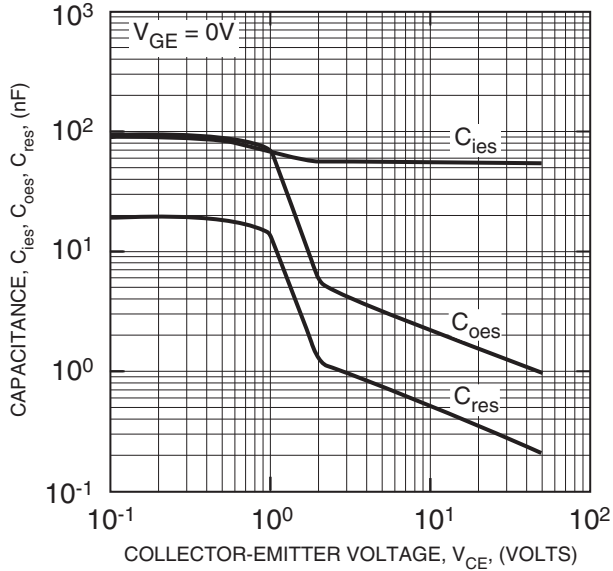


**FREE-WHEEL DIODE
 FORWARD CHARACTERISTICS
 (INVERTER PART - TYPICAL)**

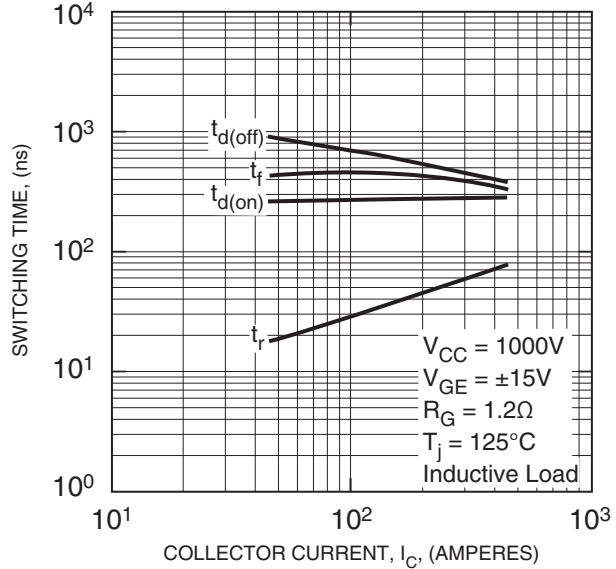


CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

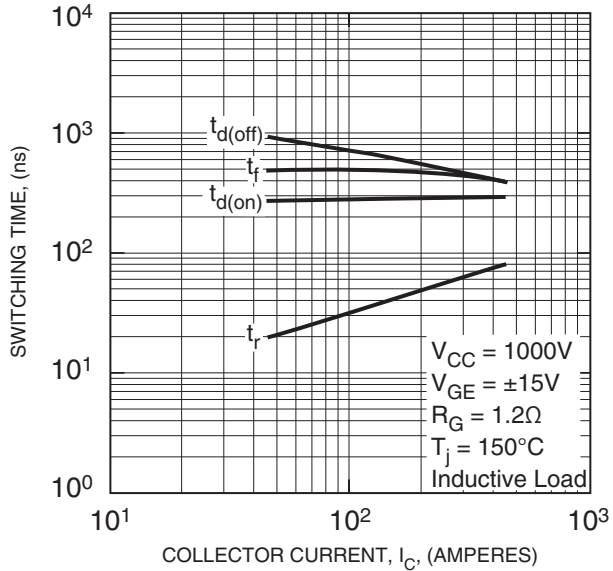
CAPACITANCE VS. V_{CE}
 (INVERTER PART - TYPICAL)



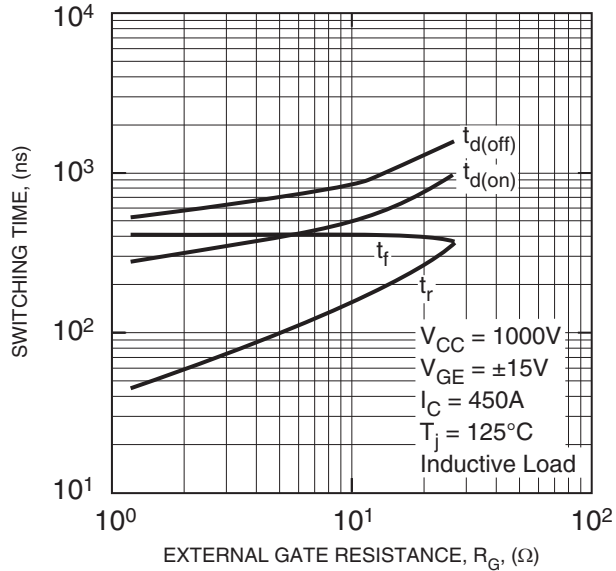
HALF-BRIDGE SWITCHING CHARACTERISTICS
 (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS
 (INVERTER PART - TYPICAL)

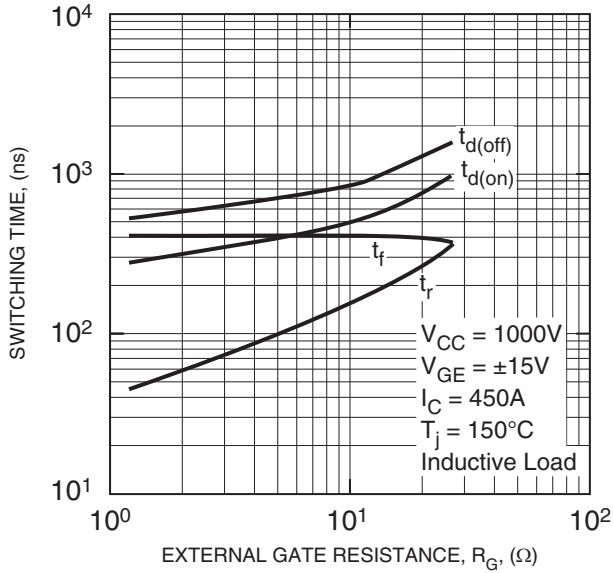


SWITCHING TIME VS. GATE RESISTANCE
 (INVERTER PART - TYPICAL)

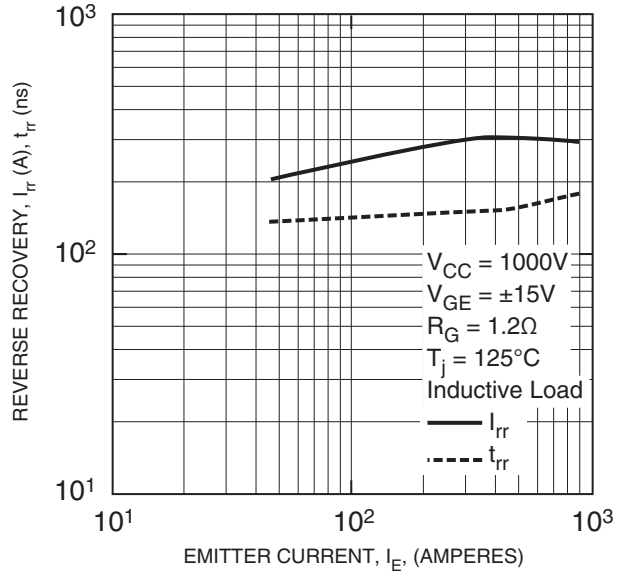


CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

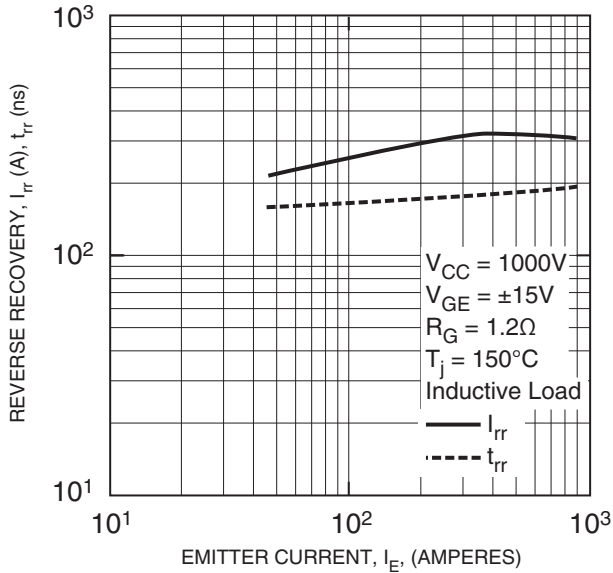
SWITCHING TIME VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



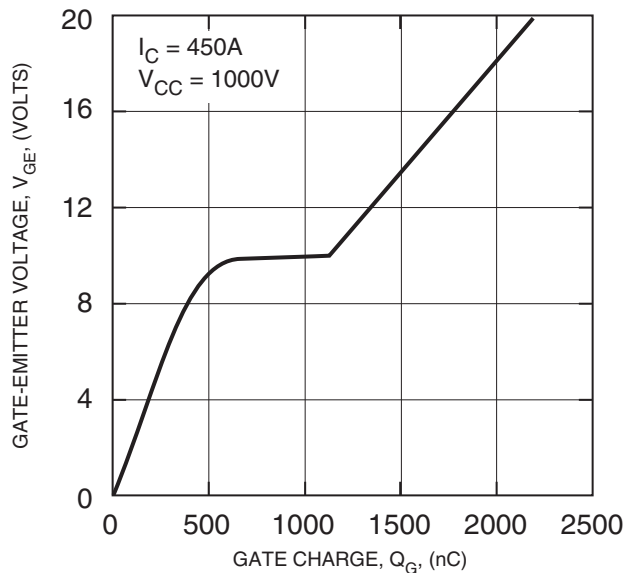
REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)

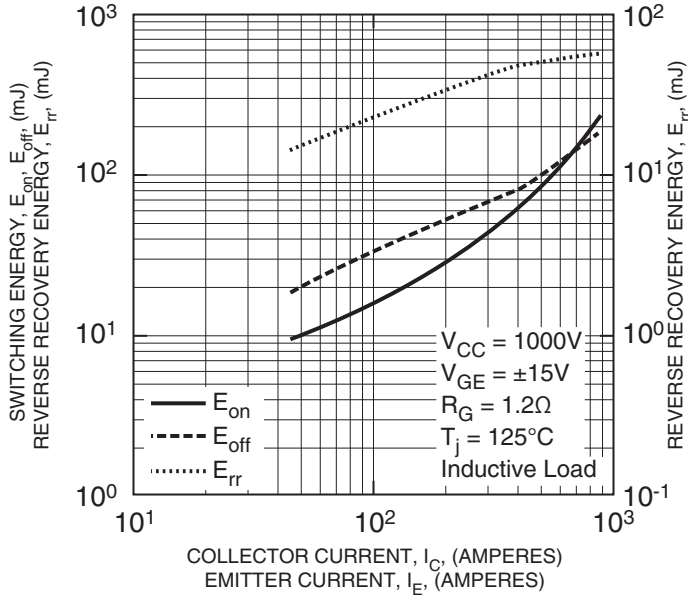


GATE CHARGE VS. V_{GE} (INVERTER PART)

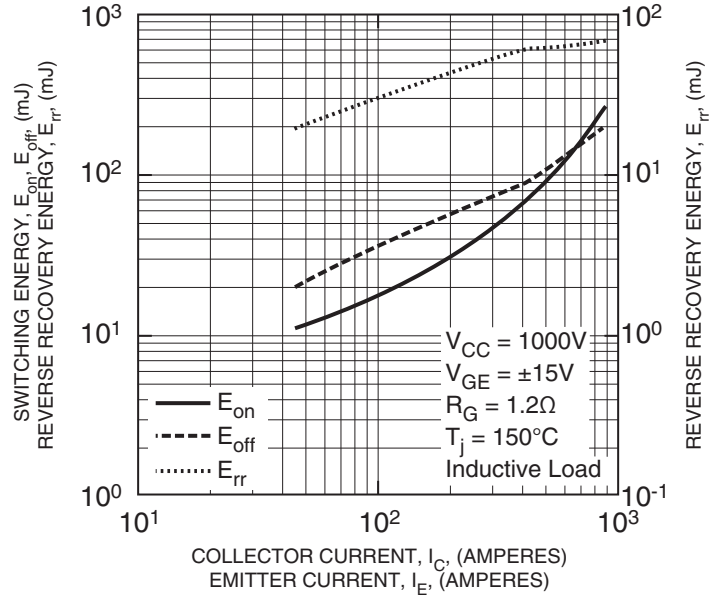


CM450DX-34SA
Dual IGBT NX-Series Module
 450 Amperes/1700 Volts

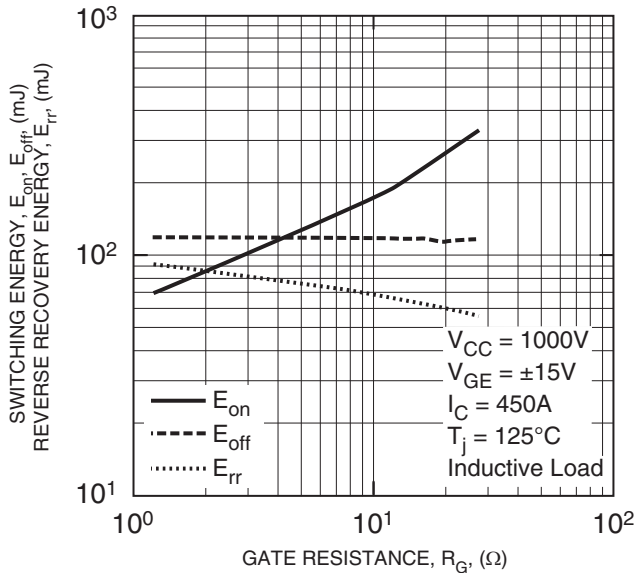
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



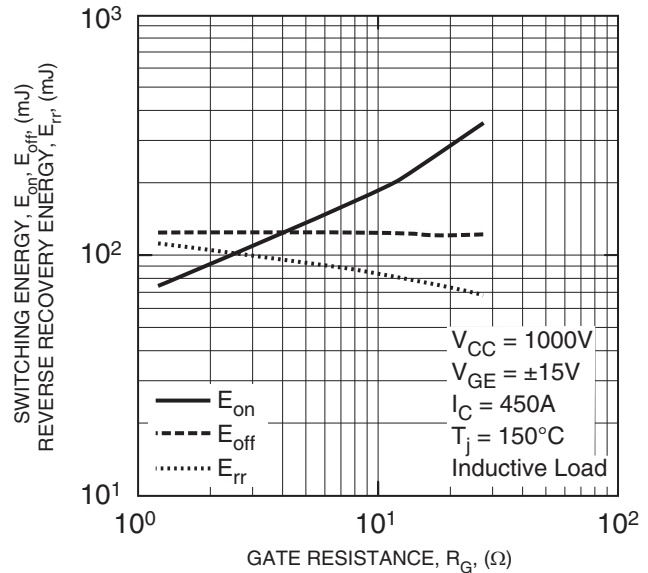
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



CM450DX-34SA
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