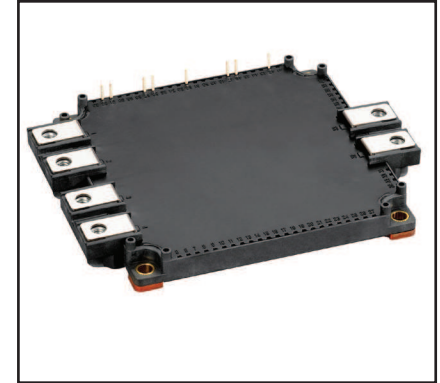
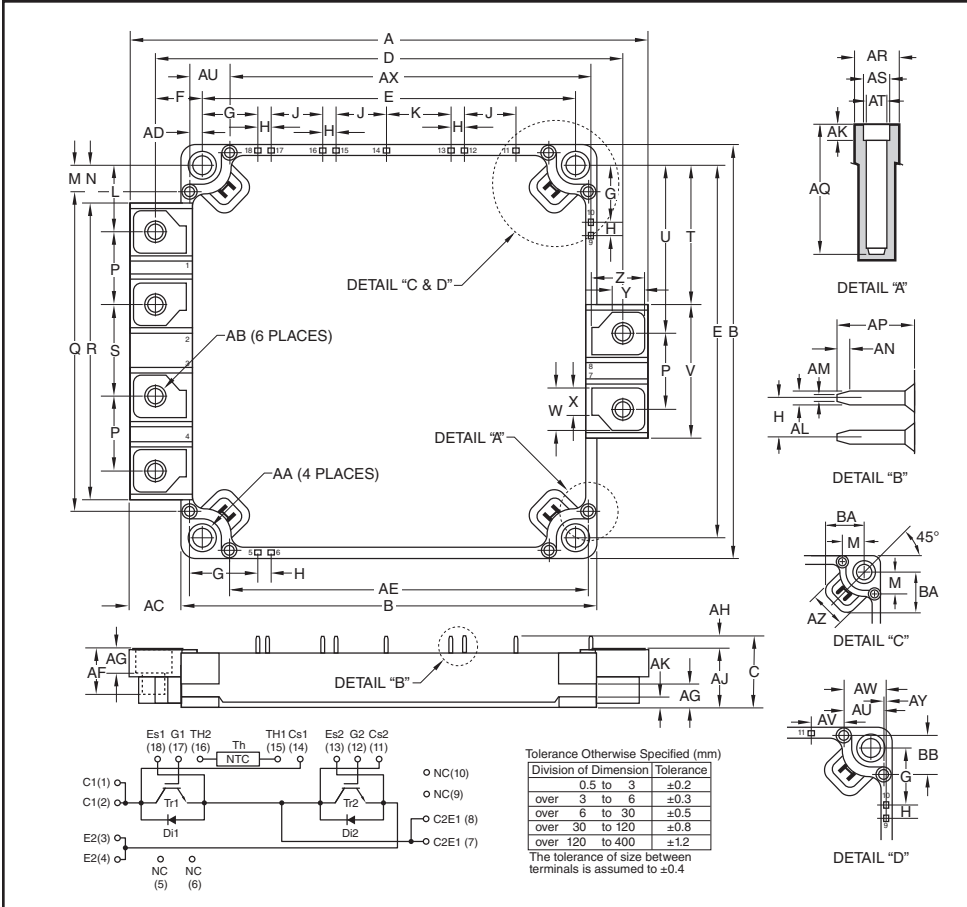


**Dual IGBT  
 NX-Series Module  
 450 Amperes/1700 Volts**



**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. CM450DXL-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	4.79	121.7
C	0.81	20.5
D	5.39	137.0
E	4.33±0.02	110.0±0.5
F	0.53	13.5
G	0.81±0.012	20.5±0.3
H	0.15	3.81
J	0.6	15.24
K	0.74±0.012	19.05±0.3
L	0.75	19.24
M	0.3	7.75
N	0.42	10.74
P	0.86	22.0
Q	3.72±0.012	94.5±0.3
R	3.48	88.53
S	1.08	27.53
T	1.62	41.22
U	1.95	49.72
V	1.53	39.0
W	0.47	12.0
X	0.31	8.0
Y	0.26	6.5
Z	0.61	15.64
AA	Dia.	5.5 Dia.

Dimensions	Inches	Millimeters
AB	M6 Metric	M6
AC	0.6	15.14
AD	0.14	3.6
AE	4.16±0.012	105.9±0.3
AF	0.55	14.0
AG	0.27	7.0
AH	0.14	3.5
AJ	0.67+0.04/-0.02	17.0+1.0/-0.5
AK	0.12	3.0
AL	0.04	1.15
AM	0.02	0.65
AN	0.05	1.2
AP	0.18	4.5
AQ	0.5	12.5
AR	0.18 Dia.	4.5 Dia.
AS	0.10 Dia.	2.6 Dia.
AT	0.09 Dia.	2.25 Dia.
AU	0.45±0.012	11.36±0.3
AV	0.36±0.012	9.15±0.3
AW	0.46±0.012	11.8±0.3
AX	4.18±0.012	106.3±0.3
AY	0.017±0.012	0.45±0.3
AZ	0.51	13.0
BA	0.54	13.7
BB	0.53±0.012	11.35±0.3

Type	Current Rating Amperes	$V_{CES}$ Volts (x 50)
CM	450	34

**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

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

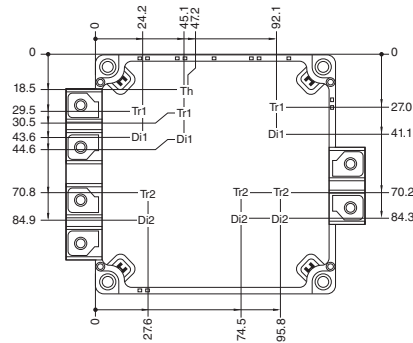
Characteristics	Symbol	Rating	Units
Collector-Emitter Voltage ( $V_{GE} = 0\text{V}$ )	$V_{CES}$	1700	Volts
Gate-Emitter Voltage ( $V_{CE} = 0\text{V}$ )	$V_{GES}$	$\pm 20$	Volts
Collector Current (DC, $T_C = 125^\circ\text{C}$ ) <sup>*2,*4</sup>	$I_C$	450	Amperes
Collector Current (Pulse, Repetitive) <sup>*3</sup>	$I_{CRM}$	900	Amperes
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ ) <sup>*2,*4</sup>	$P_{tot}$	4410	Watts
Emitter Current <sup>*2</sup>	$I_E^{*1}$	450	Amperes
Emitter Current (Pulse, Repetitive) <sup>*3</sup>	$I_{ERM}^{*1}$	900	Amperes
Isolation Voltage (Terminals to Baseplate, RMS, $f = 60\text{Hz}$ , AC 1 minute)	$V_{ISO}$	4000	Volts
Maximum Junction Temperature, Instantaneous Event (Overload)	$T_{j(max)}$	175	$^\circ\text{C}$
Maximum Case Temperature <sup>*4</sup>	$T_C(max)$	125	$^\circ\text{C}$
Operating Junction Temperature, Continuous Operation (Under Switching)	$T_{j(op)}$	-40 to +150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-40 to +125	$^\circ\text{C}$

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

\*2 Junction temperature ( $T_j$ ) should not increase beyond maximum junction temperature ( $T_{j(max)}$ ) rating.

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

\*4 Case temperature ( $T_C$ ) 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.



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

**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

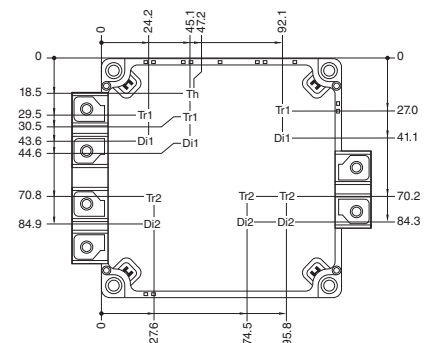
**Electrical Characteristics,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Emitter Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	—	—	1.0	mA
Gate-Emitter Leakage Current	$I_{GES}$	$V_{GE} = V_{GES}, V_{CE} = 0V$	—	—	0.5	$\mu\text{A}$
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 (Terminal)	$V_{CE(sat)}$	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^5$	—	2.0	2.5	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 125^\circ\text{C}^5$	—	2.2	—	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}^5$	—	2.25	—	Volts
Collector-Emitter Saturation Voltage (Chip)	$V_{CE(sat)}$	$I_C = 450\text{A}, V_{GE} = 15V, T_j = 25^\circ\text{C}^5$	—	1.9	2.4	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 125^\circ\text{C}^5$	—	2.1	—	Volts
		$I_C = 450\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}^5$	—	2.15	—	Volts
Input Capacitance	$C_{ies}$		—	—	119	nF
Output Capacitance	$C_{oes}$	$V_{CE} = 10V, V_{GE} = 0V$	—	—	9.8	nF
Reverse Transfer Capacitance	$C_{res}$		—	—	2.2	nF
Gate Charge	$Q_G$	$V_{CC} = 1000V, I_C = 450\text{A}, V_{GE} = 15V$	—	2480	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	—	900	ns
Rise Time	$t_r$	$V_{CC} = 1000V, I_C = 450\text{A}, V_{GE} = \pm 15V,$	—	—	150	ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 0\Omega, \text{ Inductive Load}$	—	—	900	ns
Fall Time	$t_f$		—	—	400	ns
Emitter-Collector Voltage (Terminal)	$V_{EC}^*1$	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^5$	—	4.1	5.3	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 125^\circ\text{C}^5$	—	2.9	—	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 150^\circ\text{C}^5$	—	2.7	—	Volts
Emitter-Collector Voltage (Chip)	$V_{EC}^*1$	$I_E = 450\text{A}, V_{GE} = 0V, T_j = 25^\circ\text{C}^5$	—	4.0	5.2	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 125^\circ\text{C}^5$	—	2.8	—	Volts
		$I_E = 450\text{A}, V_{GE} = 0V, T_j = 150^\circ\text{C}^5$	—	2.6	—	Volts
Reverse Recovery Time	$t_{rr}^*1$	$V_{CC} = 1000V, I_E = 450\text{A}, V_{GE} = \pm 15V$	—	—	300	ns
Reverse Recovery Charge	$Q_{rr}^*1$	$R_G = 0\Omega, \text{ Inductive Load}$	—	17	—	$\mu\text{C}$
Turn-on Switching Energy per Pulse	$E_{on}$	$V_{CC} = 1000V, I_C = I_E = 450\text{A}, V_{GE} = \pm 15V$	—	147	—	mJ
Turn-off Switching Energy per Pulse	$E_{off}$	$R_G = 0\Omega, T_j = 150^\circ\text{C}$	—	129	—	mJ
Reverse Recovery Energy per Pulse	$E_{rr}^*1$	Inductive Load	—	73	—	mJ
Internal Lead Resistance	$R_{CC}^* + EE^*$	Main Terminals-Chip, Per Switch, $T_C = 25^\circ\text{C}^4$	—	—	0.6	m $\Omega$
Internal Gate Resistance	$r_g$	Per Switch	—	3.2	—	$\Omega$

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

\*4 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.

**CM450DXL-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	$R_{25}$	$T_C = 25^\circ\text{C}^{*4}$	4.85	5.00	5.15	k $\Omega$
Deviation of Resistance	$\Delta R/R$	$T_C = 100^\circ\text{C}$ , $R_{100} = 493\Omega^{*4}$	-7.3	—	+7.8	%
B Constant	$B_{(25/50)}$	Approximate by Equation <sup>*6</sup>	—	3375	—	K
Power Dissipation	$P_{25}$	$T_C = 25^\circ\text{C}^{*4}$	—	—	10	mW

**Thermal Resistance Characteristics**

Thermal Resistance, Junction to Case	$R_{th(j-c)Q}$	Per Inverter IGBT <sup>*4</sup>	—	—	34	K/kW
Thermal Resistance, Junction to Case	$R_{th(j-c)D}$	Per Inverter FWD <sup>*4</sup>	—	—	52	K/kW
Contact Thermal Resistance, Case to Heatsink <sup>*2</sup>	$R_{th(c-f)}$	Thermal Grease Applied, Per 1 Module <sup>*4,*7</sup>	—	7	—	K/kW

**Mechanical Characteristics**

Mounting Torque	$M_t$	Main Terminals, M6 Screw	31	35	40	in-lb
	$M_s$	Mounting to Heatsink, M5 Screw	22	27	31	in-lb
Creepage Distance	$d_s$	Terminal to Terminal	22.5	—	—	mm
		Terminal to Baseplate	16.8	—	—	mm
Clearance	$d_a$	Terminal to Terminal	15.5	—	—	mm
		Terminal to Baseplate	11.3	—	—	mm
Weight	$m$		—	690	—	Grams
Flatness of Baseplate	$e_c$	On Centerline X, Y <sup>*8</sup>	$\pm 0$	—	+100	$\mu\text{m}$

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

DC Supply Voltage	$V_{CC}$	Applied Across C1-E2 Terminals	—	1000	1200	Volts
Gate-Emitter Drive Voltage	$V_{GE(on)}$	Applied Across	13.5	15.0	16.5	Volts
		G1-Es1/G2-Es2 Terminals				
External Gate Resistance	$R_G$	Per Switch	0	—	18	$\Omega$

<sup>\*4</sup> 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.

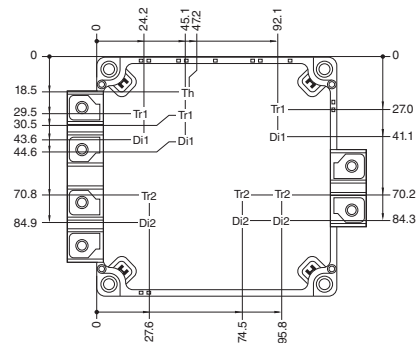
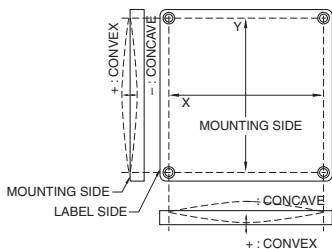
$$^{*6} B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$$

$R_{25}$ ; 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]

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

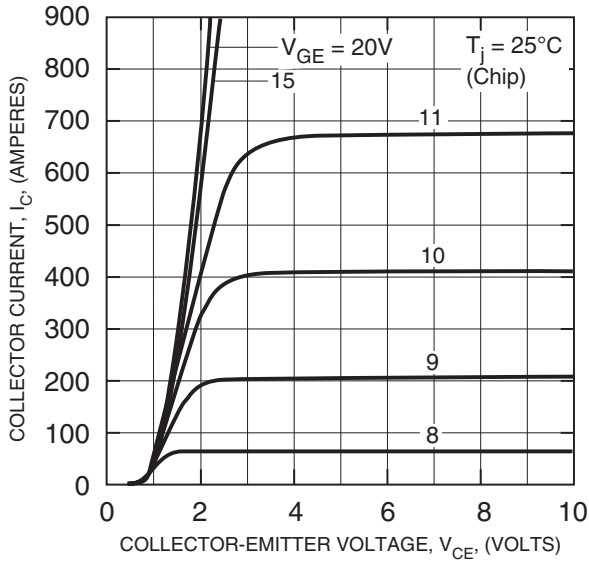
<sup>\*8</sup> Baseplate (mounting side) flatness measurement points (X, Y) are shown in the figure below.



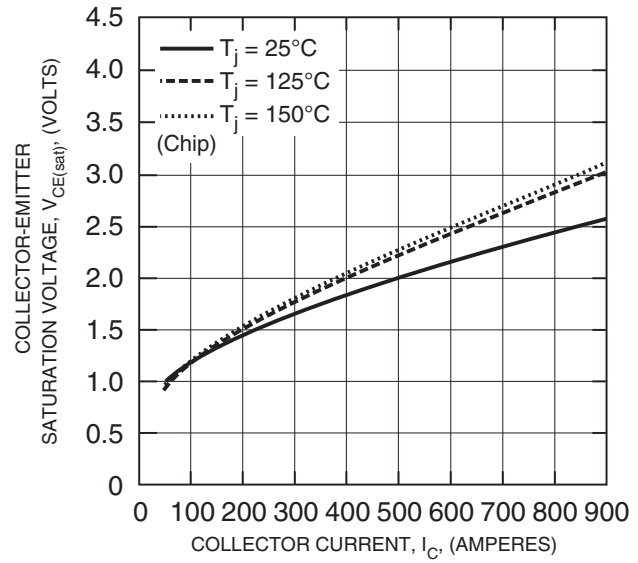
Tr1 / Tr2: IGBT, Di1 / Di2: FWD, Th: NTC Thermistor  
 Each mark points to the center position of each chip.

**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

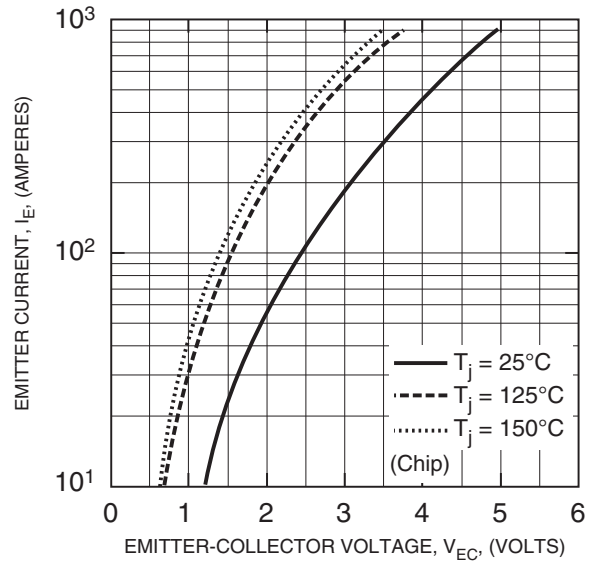
**OUTPUT CHARACTERISTICS  
 (INVERTER PART - TYPICAL)**



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

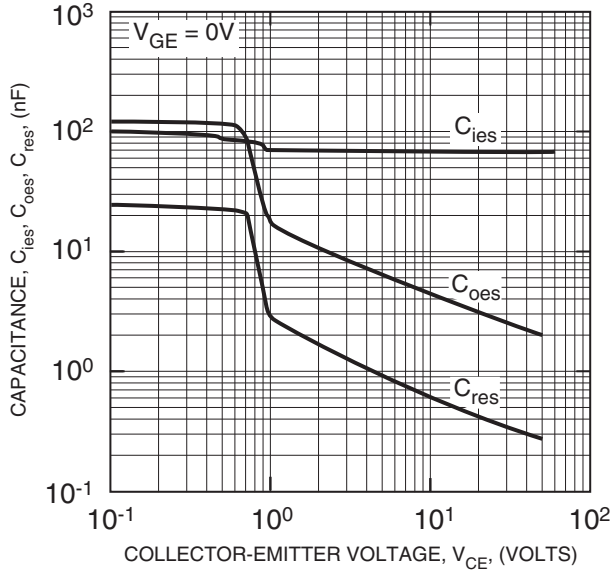


**FREE-WHEEL DIODE  
 FORWARD CHARACTERISTICS  
 (INVERTER PART - TYPICAL)**

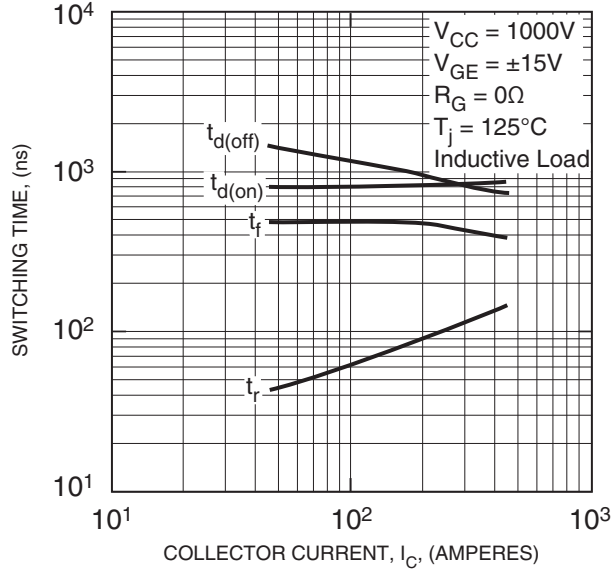


**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

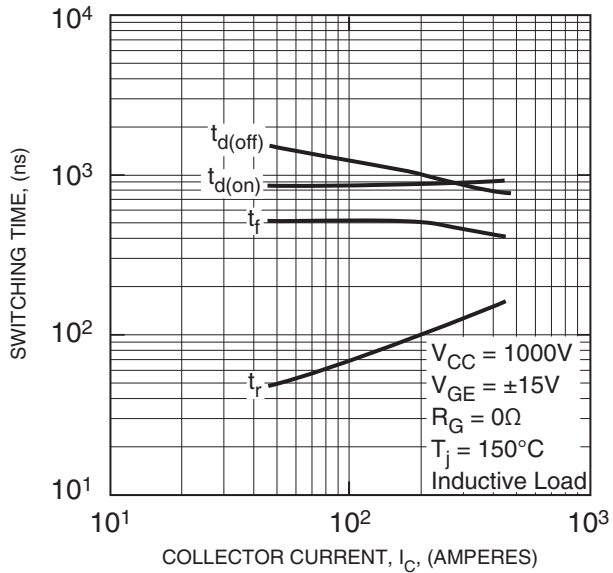
**CAPACITANCE VS.  $V_{CE}$**   
 (INVERTER PART - TYPICAL)



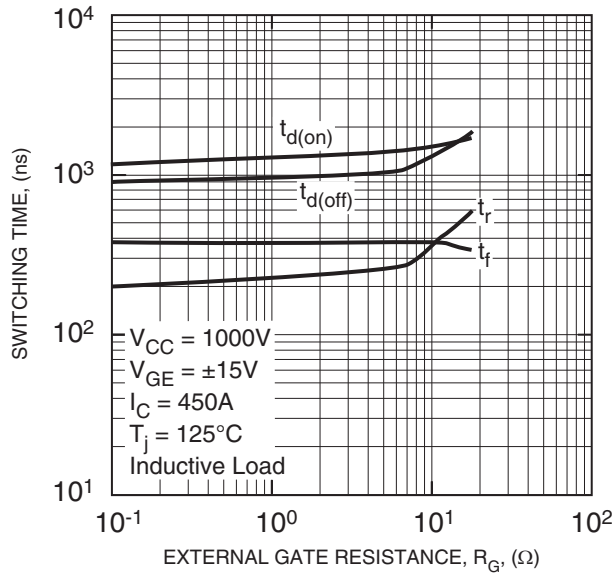
**HALF-BRIDGE SWITCHING CHARACTERISTICS**  
 (INVERTER PART - TYPICAL)



**HALF-BRIDGE SWITCHING CHARACTERISTICS**  
 (INVERTER PART - TYPICAL)

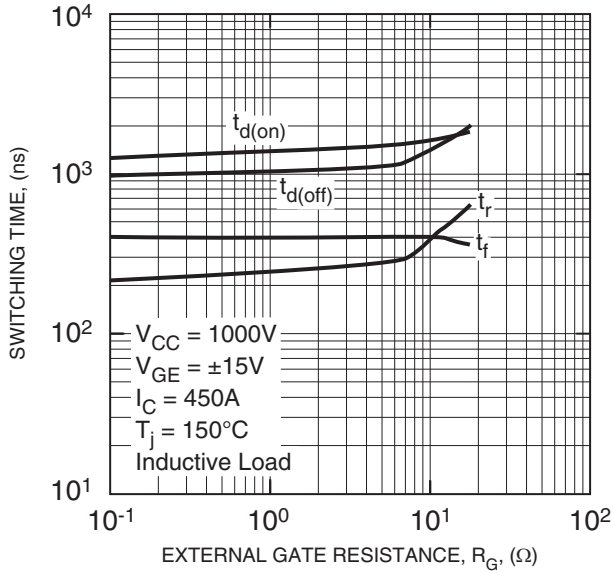


**SWITCHING TIME VS. GATE RESISTANCE**  
 (INVERTER PART - TYPICAL)

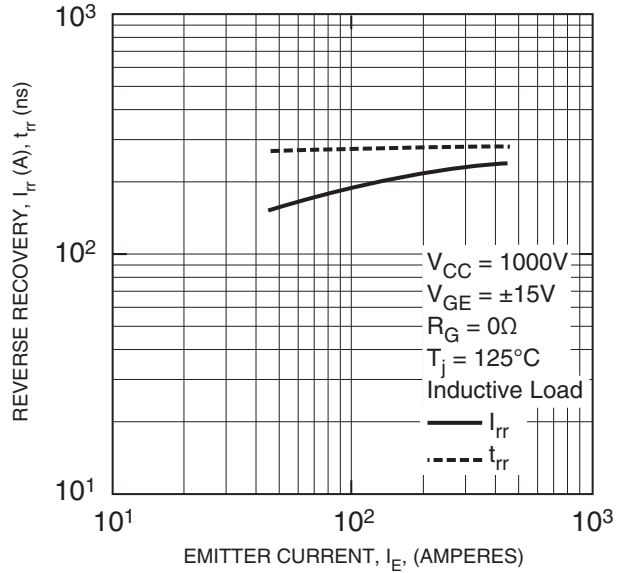


**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

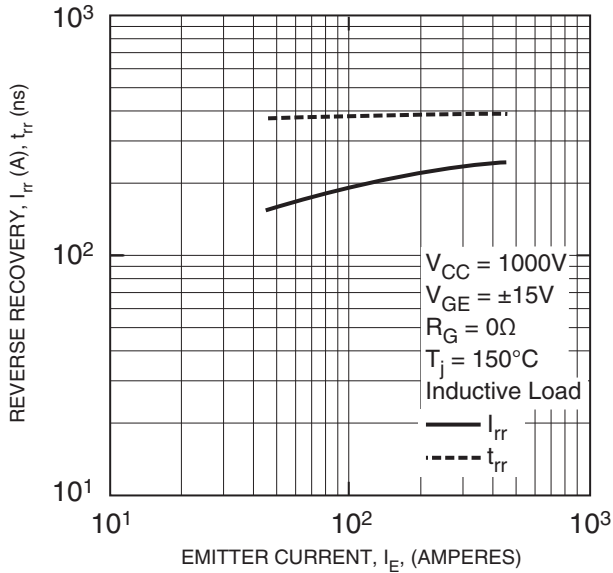
**SWITCHING TIME VS. GATE RESISTANCE (INVERTER PART - TYPICAL)**



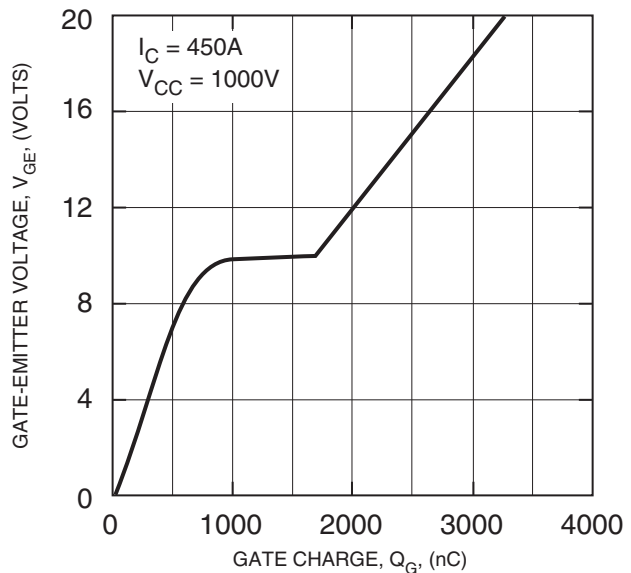
**REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)**



**REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)**

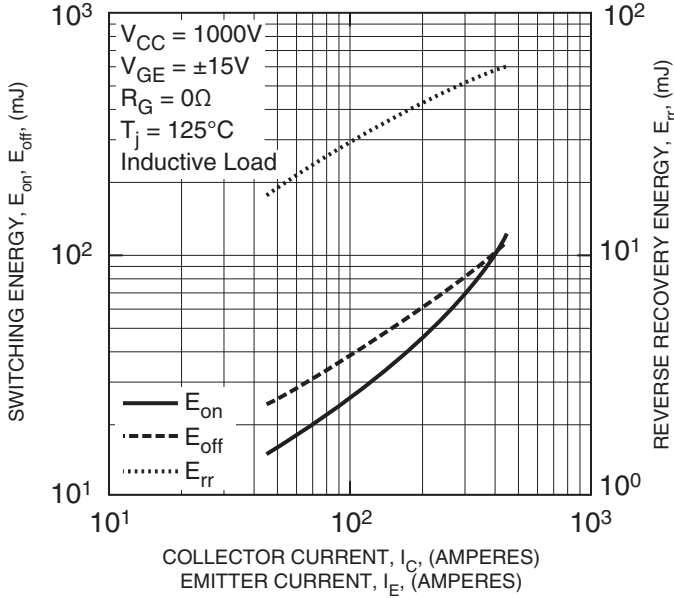


**GATE CHARGE VS.  $V_{GE}$  (INVERTER PART)**

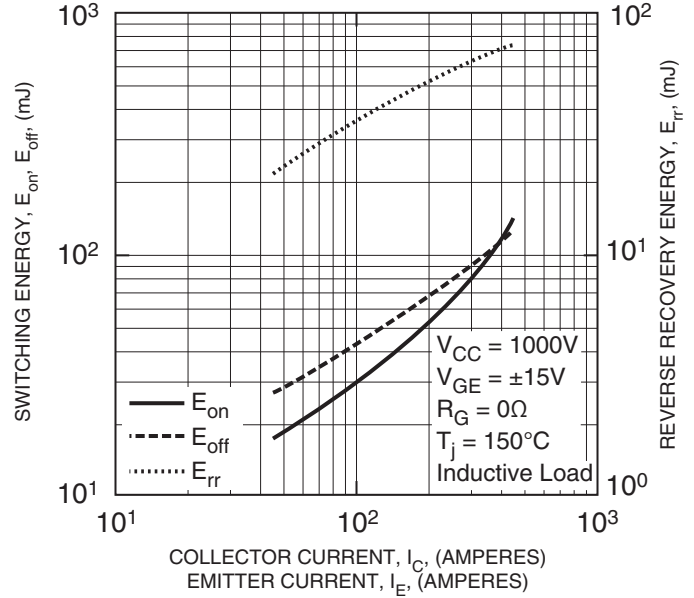


**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

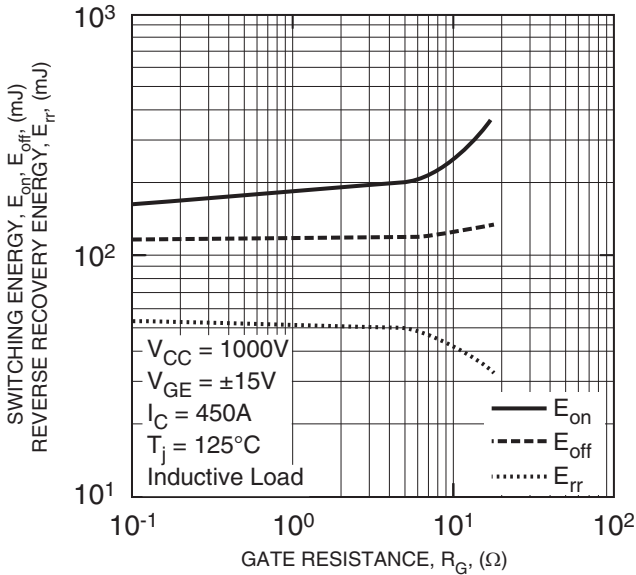
**HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)**



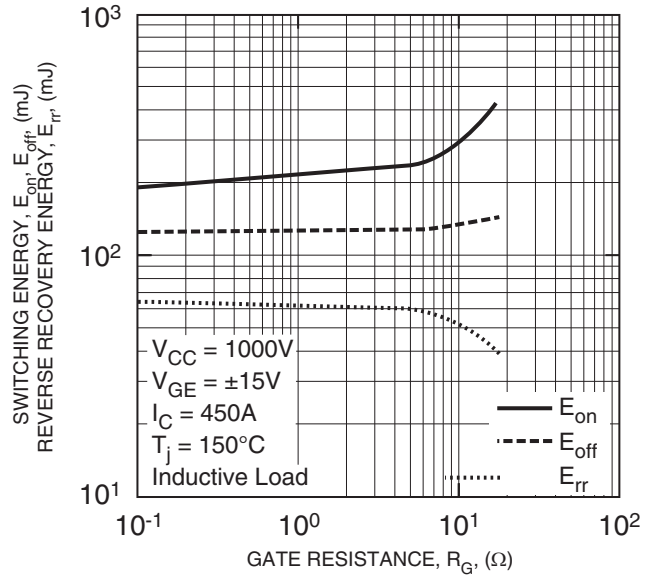
**HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)**



**HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)**

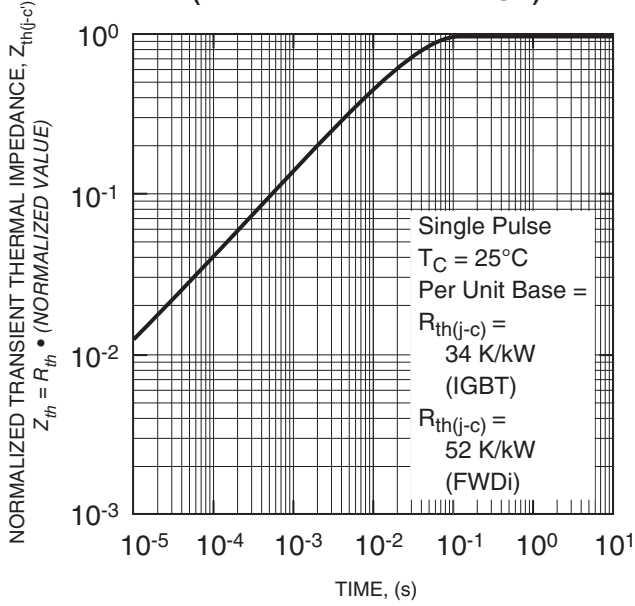


**HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)**



**CM450DXL-34SA**  
**Dual IGBT NX-Series Module**  
 450 Amperes/1700 Volts

**TRANSIENT THERMAL  
 IMPEDANCE CHARACTERISTICS  
 (INVERTER PART - MAXIMUM)**



**TEMPERATURE CHARACTERISTICS  
 (NTC THERMISTER PART - TYPICAL)**

