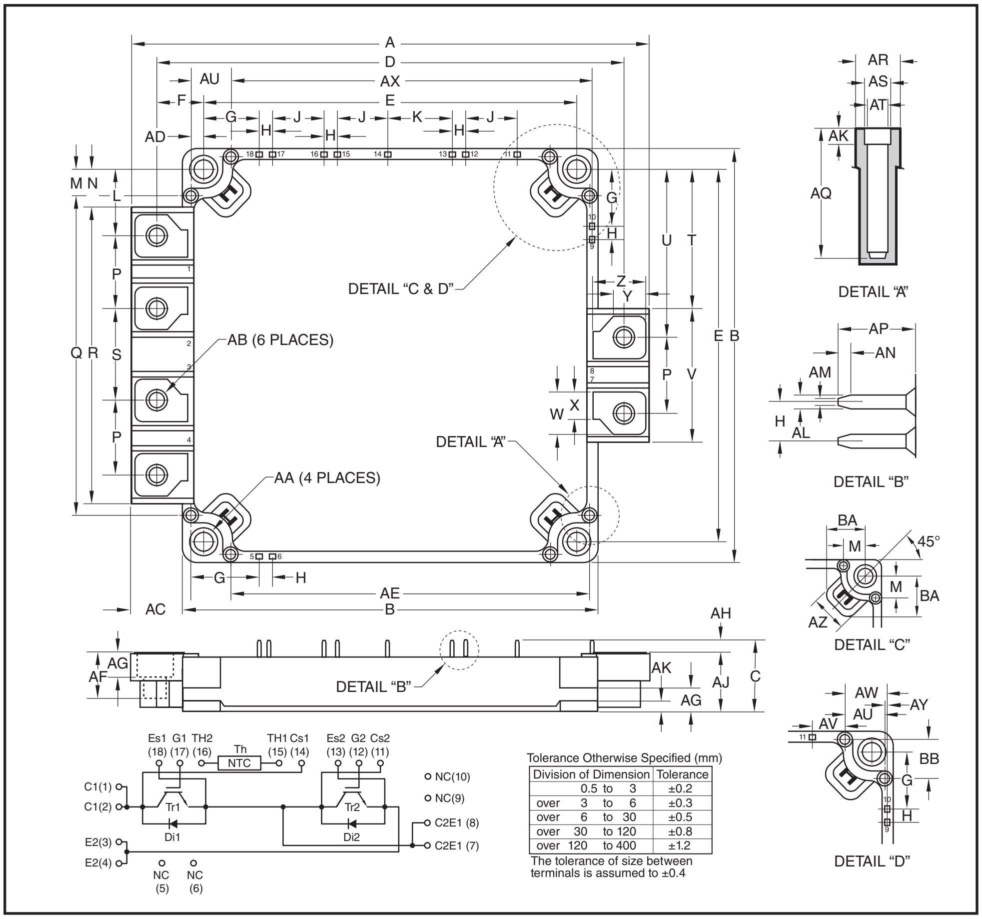
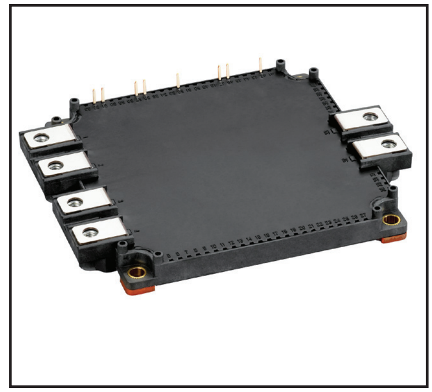
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

CM450DXL-34SA

Dual IGBT
NX-Series Module
450 Amperes/1700 Volts



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

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.

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

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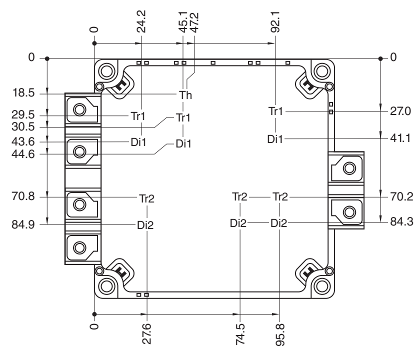
Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

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

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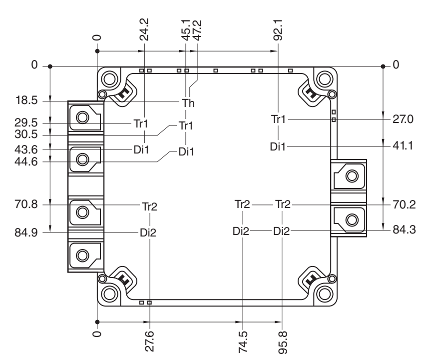
Electrical Characteristics, T_j = 25°C unless otherwise specified

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	µA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 45mA, V_{CE} = 10V	5.4	6.0	6.6	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 450A, V_{GE} = 15V, T_j = 25°C*5	—	2.0	2.5	Volts
	(Terminal)	I_C = 450A, V_{GE} = 15V, T_j = 125°C*5	—	2.2	—	Volts
		I_C = 450A, V_{GE} = 15V, T_j = 150°C*5	—	2.25	—	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 450A, V_{GE} = 15V, T_j = 25°C*5	—	1.9	2.4	Volts
	(Chip)	I_C = 450A, V_{GE} = 15V, T_j = 125°C*5	—	2.1	—	Volts
		I_C = 450A, V_{GE} = 15V, T_j = 150°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 = 450A, V_{GE} = 15V	—	2480	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	—	900	ns
Rise Time	t_r	V_{CC} = 1000V, I_C = 450A, V_{GE} = ±15V,	—	—	150	ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 0Ω, Inductive Load	—	—	900	ns
Fall Time	t_f		—	—	400	ns
Emitter-Collector Voltage	V_{EC}*1	I_E = 450A, V_{GE} = 0V, T_j = 25°C*5	—	4.1	5.3	Volts
	(Terminal)	I_E = 450A, V_{GE} = 0V, T_j = 125°C*5	—	2.9	—	Volts
		I_E = 450A, V_{GE} = 0V, T_j = 150°C*5	—	2.7	—	Volts
Emitter-Collector Voltage	V_{EC}*1	I_E = 450A, V_{GE} = 0V, T_j = 25°C*5	—	4.0	5.2	Volts
	(Chip)	I_E = 450A, V_{GE} = 0V, T_j = 125°C*5	—	2.8	—	Volts
		I_E = 450A, V_{GE} = 0V, T_j = 150°C*5	—	2.6	—	Volts
Reverse Recovery Time	t_{rr}*1	V_{CC} = 1000V, I_E = 450A, V_{GE} = ±15V	—	—	300	ns
Reverse Recovery Charge	Q_{rr}*1	R_G = 0Ω, Inductive Load	—	17	—	µC
Turn-on Switching Energy per Pulse	E_{on}	V_{CC} = 1000V, $I_C = I_E$ = 450A, V_{GE} = ±15V	—	147	—	mJ
Turn-off Switching Energy per Pulse	E_{off}	R_G = 0Ω, T_j = 150°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°C*4	—	—	0.6	mΩ
Internal Gate Resistance	r_g	Per Switch	—	3.2	—	Ω

*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.



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Electrical Characteristics, T_j = 25°C unless otherwise specified (continued)

NTC Thermistor Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Zero Power Resistance	R_{25}	T_C = 25°C*4	4.85	5.00	5.15	kΩ
Deviation of Resistance	ΔR/R	T_C = 100°C, R_{100} = 493Ω*4	-7.3	—	+7.8	%
B Constant	$B_{(25/50)}$	Approximate by Equation*6	—	3375	—	K
Power Dissipation	P_{25}	T_C = 25°C*4	—	—	10	mW

Thermal Resistance Characteristics

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistance, Junction to Case	$R_{th(j-c)}Q$	Per Inverter IGBT*4	—	—	34	K/kW
Thermal Resistance, Junction to Case	$R_{th(j-c)}D$	Per Inverter FWDi*4	—	—	52	K/kW
Contact Thermal Resistance, Case to Heatsink*2	$R_{th(c-f)}$	Thermal Grease Applied, Per 1 Module*4,*7	—	7	—	K/kW

Mechanical Characteristics

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
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*8	±0	—	+100	µm

Recommended Operating Conditons, T_a = 25°C

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
DC Supply Voltage	V_{CC}	Applied Across C1-E2 Terminals	—	1000	1200	Volts
Gate-Emitter Drive Voltage	$V_{GE(on)}$	Applied Across G1-Es1/G2-Es2 Terminals	13.5	15.0	16.5	Volts
External Gate Resistance	R_G	Per Switch	0	—	18	Ω

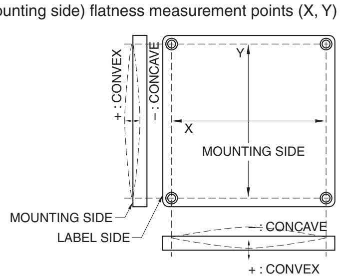
*4 Case temperature (T_C) and heatsink temperature (T_s) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.

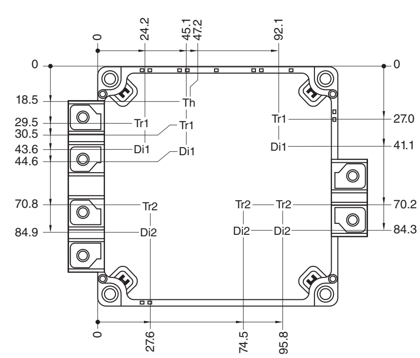
*6 $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right)/\left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

R_{25}; Resistance at Absolute Temperature T_{25} [K]; T_{25} = 25 [°C] + 273.15 = 298.15 [K]
R_{50}; Resistance at Absolute Temperature T_{50} [K]; T_{50} = 50 [°C] + 273.15 = 323.15 [K]

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

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





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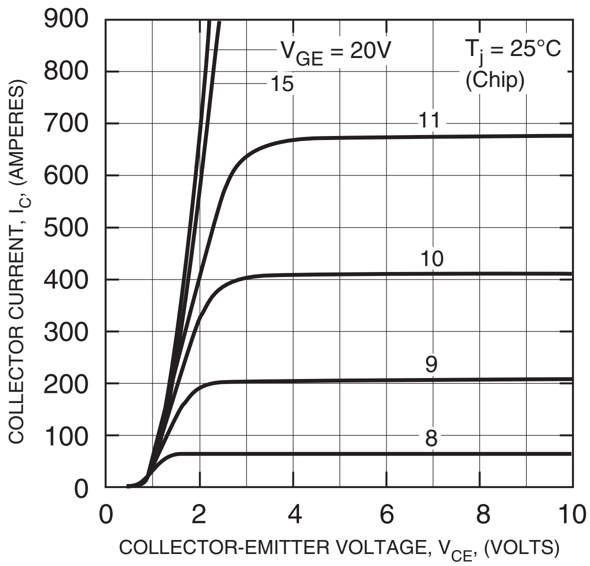
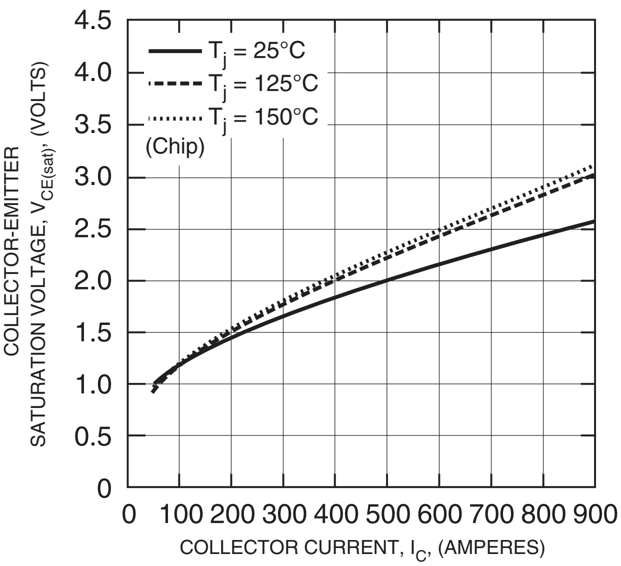
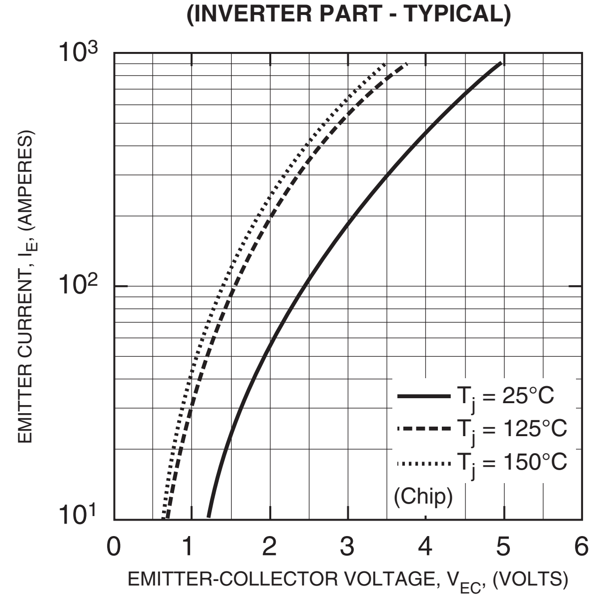
OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)



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



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



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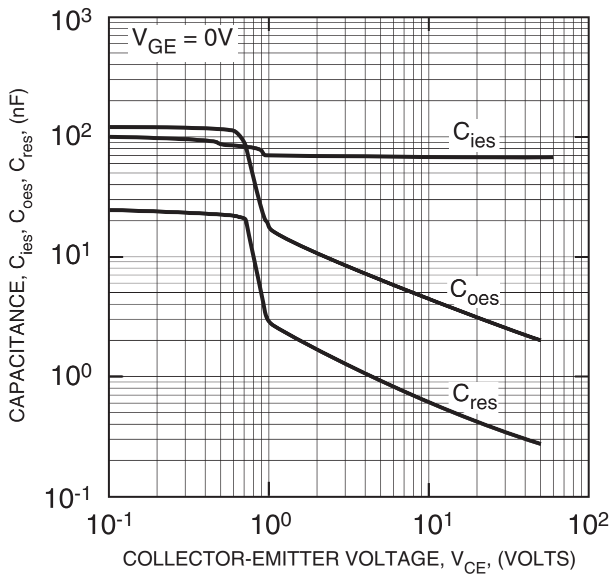
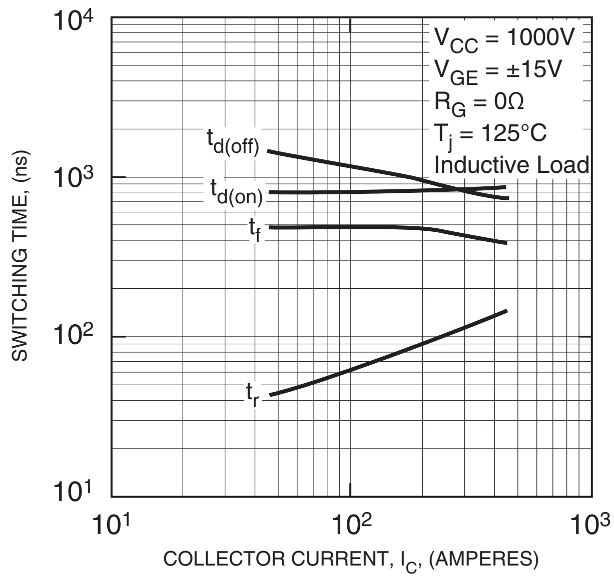
CAPACITANCE VS. V_{CE}
(INVERTER PART - TYPICAL)



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(INVERTER PART - TYPICAL)



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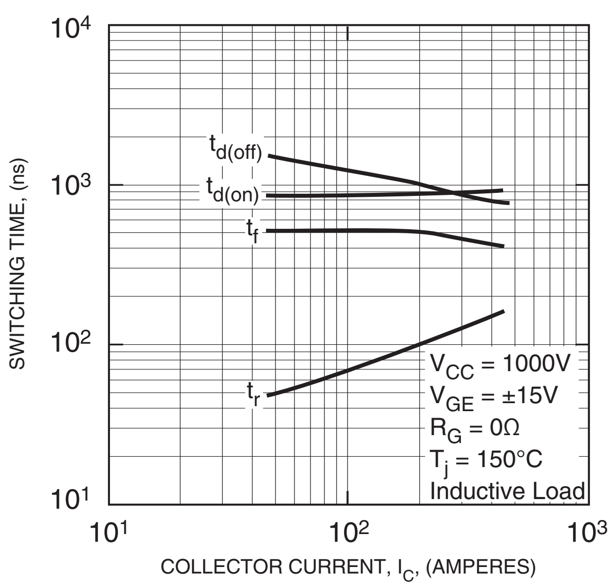
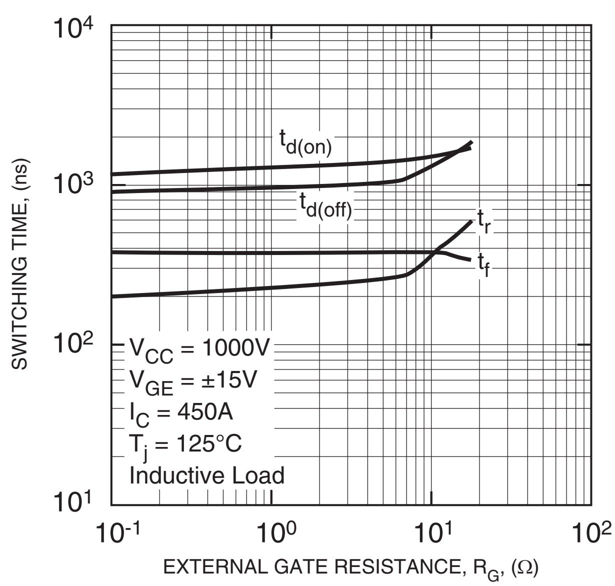


SWITCHING TIME VS.
GATE RESISTANCE
(INVERTER PART - TYPICAL)



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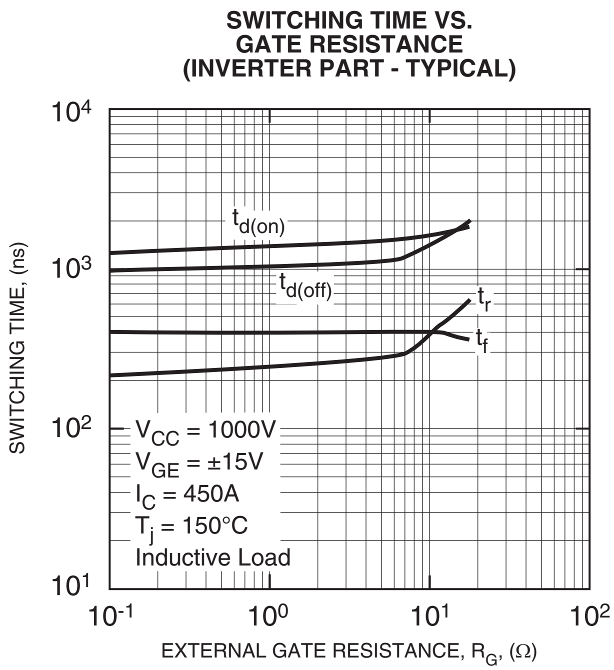

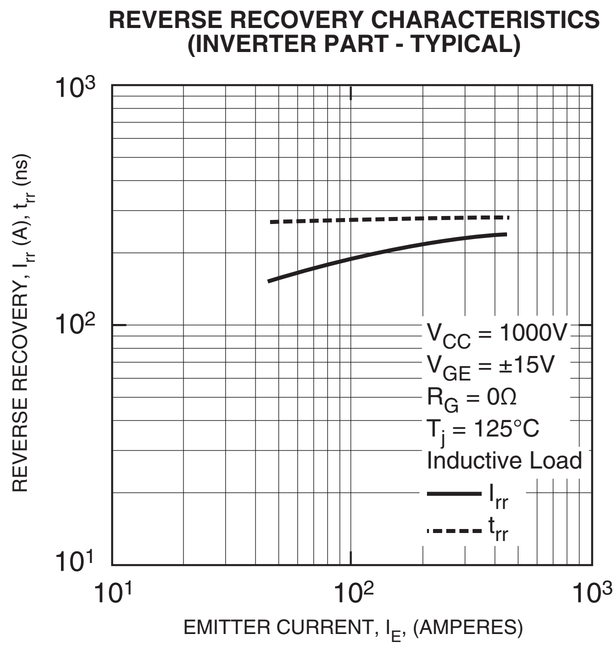

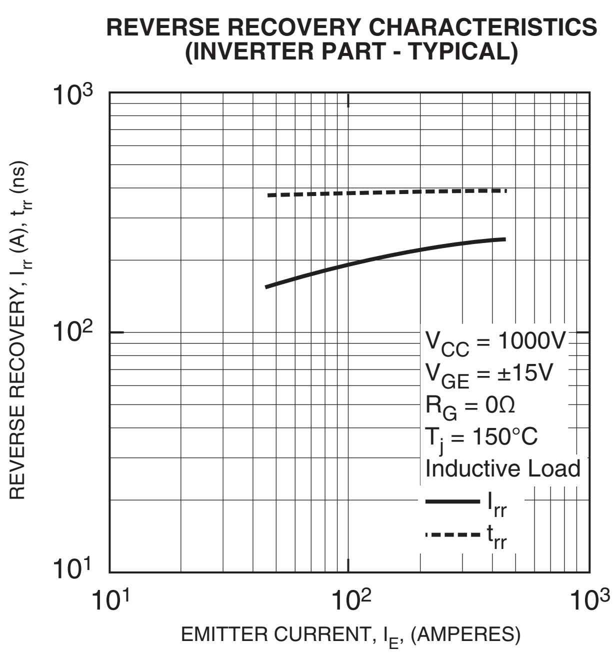

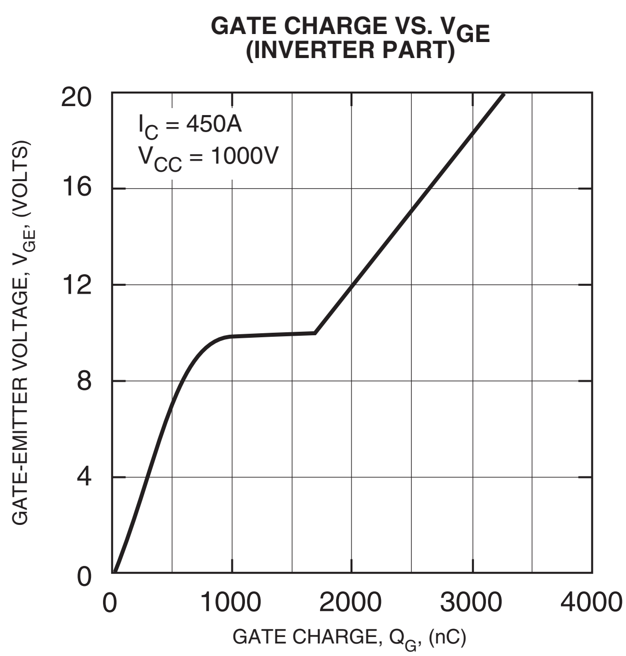

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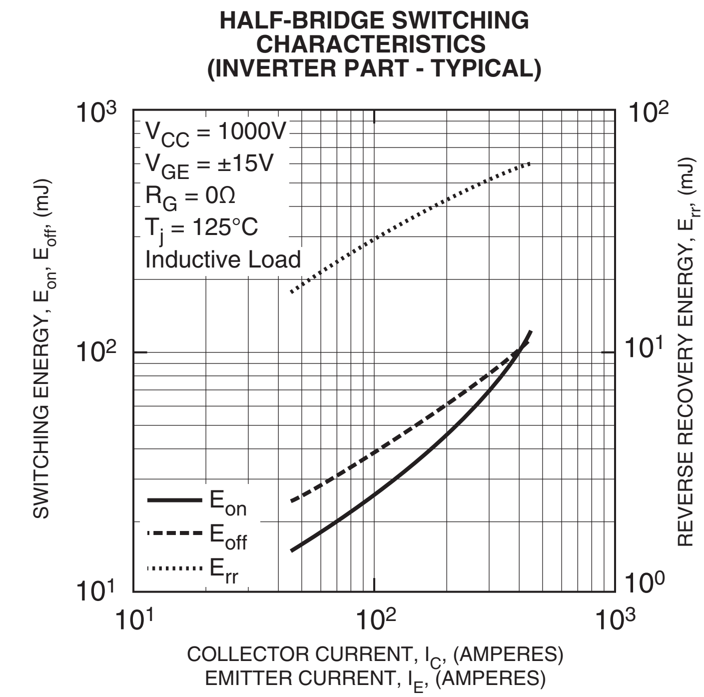

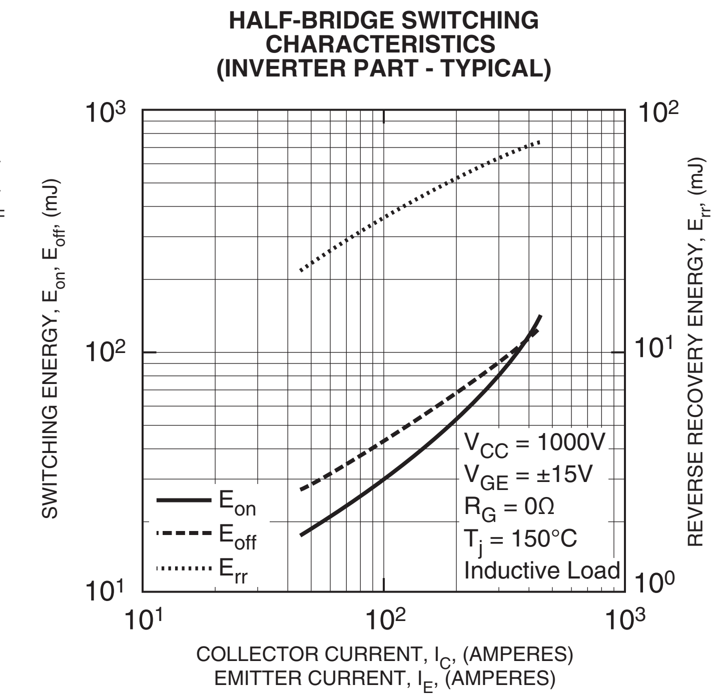

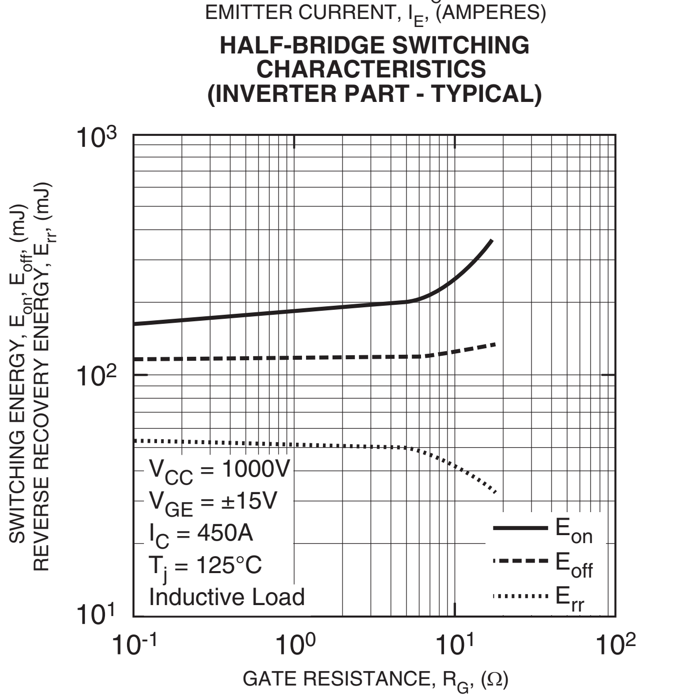

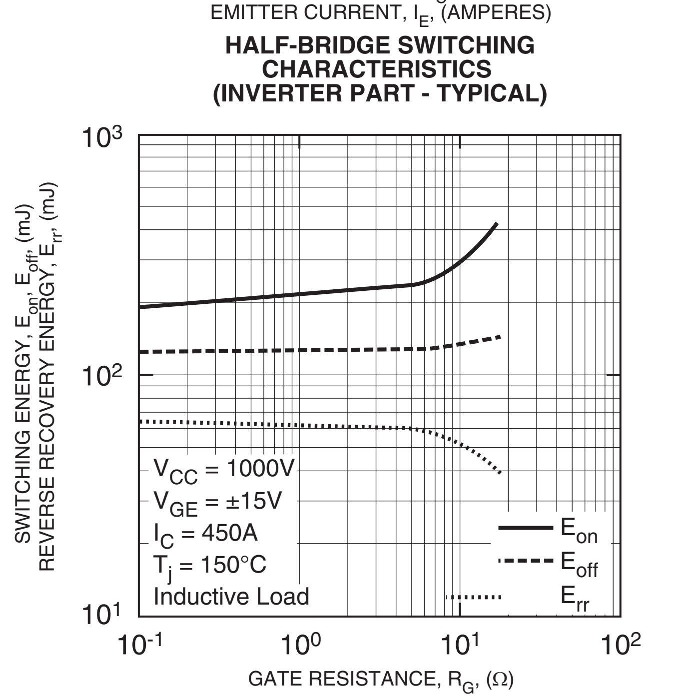

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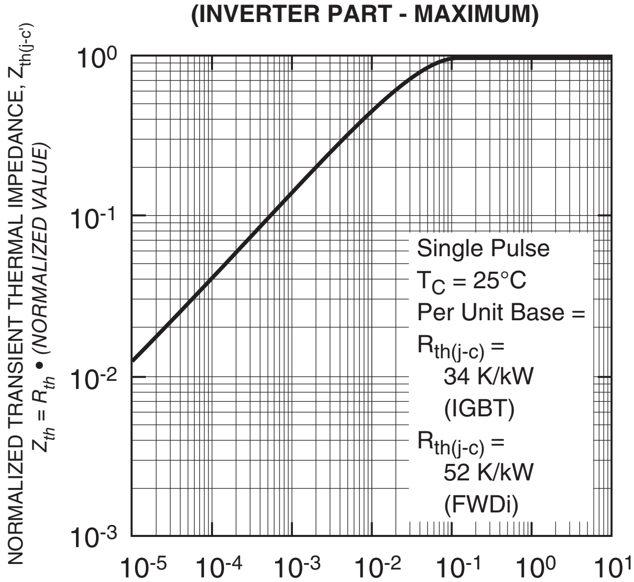
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (INVERTER PART - MAXIMUM)



TEMPERATURE CHARACTERISTICS (NTC THERMISTER PART - TYPICAL)