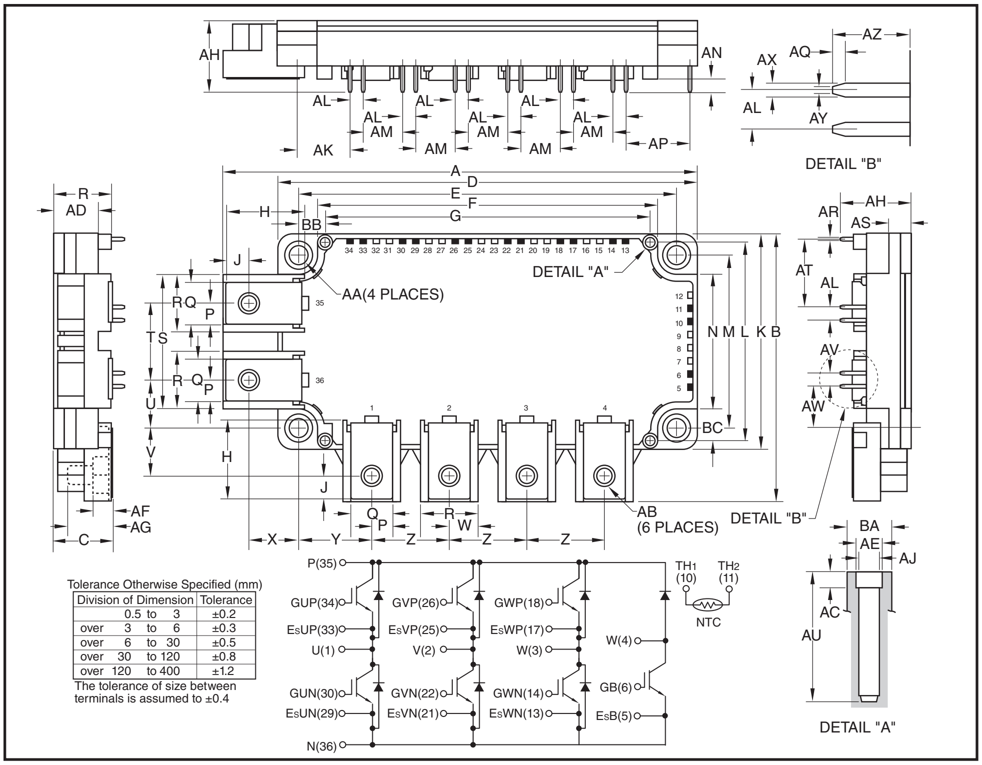
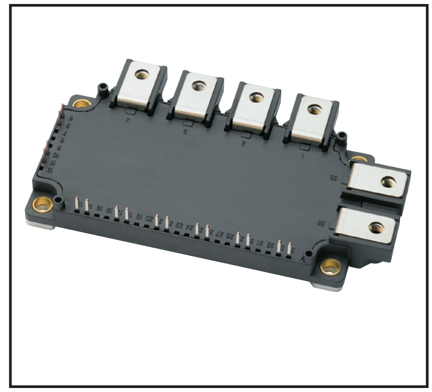
CM150RX-24S

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

Six IGBT + Brake NX-Series Module
150 Amperes/1200 Volts



Outline Drawing and Circuit Diagram



Dimensions	Inches	Millimeters
A	5.39	136.9
B	3.03	77.1
C	0.67+0.04/-0.02	17.0+1.0/-0.5
D	4.79	121.7
E	4.33±0.02	110.0±0.5
F	3.89	99.0
G	3.72	94.5
H	0.83	21.14
J	0.37	6.5
K	2.44	62.0
L	2.26	57.5
M	1.97±0.02	50.0±0.5
N	1.53	39.0
P	0.24	6.0
Q	0.48	12.0
R	0.67	17.0
S	1.53	39.0
T	0.87	22.0
U	0.55	14.0
V	0.54	13.64
W	0.33	8.5
X	0.53	13.5
Y	0.81	20.71
Z	0.9	22.86
AA	0.22 Dia.	5.5 Dia.
AB	M5	M5

Dimensions	Inches	Millimeters
AC	0.12	3.0
AD	0.51	13.0
AE	0.102 Dia.	2.6 Dia.
AF	0.21	5.4
AG	0.49	12.5
AH	0.81	20.5
AJ	0.088 Dia.	2.25 Dia.
AK	0.59	15.00
AL	0.15	3.81
AM	0.45	11.43
AN	0.14	3.5
AP	0.75	19.05
AQ	0.05	1.2
AR	0.03	0.8
AS	0.27	7.0
AT	0.77	19.68
AU	0.49	12.5
AV	0.60	15.24
AW	0.46	11.66
AX	0.04	1.15
AY	0.02	0.65
AZ	0.29	7.4
BA	0.17 Dia.	4.3 Dia.
BB	0.30	7.75
BC	0.14	3.75

Description:
Powerex IGBT Modules are designed for use in switching applications. Each module consists of six IGBT Transistors in a three phase bridge configuration and a seventh IGBT with free-wheel diode for dynamic braking. 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. CM150RX-24S is a 1200V (V_{CES}), 150 Ampere Six-IGBT + Brake Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 50)
CM	150	24

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

Inverter Part IGBT/FWDi

Characteristics	Symbol	Rating	Units
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 = 120°C)*2,*4	I_C	150	Amperes
Collector Current (Pulse, Repetitive)*3	I_{CRM}	300	Amperes
Total Power Dissipation (T_C = 25°C)*2,*4	P_{tot}	1150	Watts
Emitter Current*2	I_E*1	150	Amperes
Emitter Current (Pulse, Repetitive)*3	I_{ERM}*1	300	Amperes

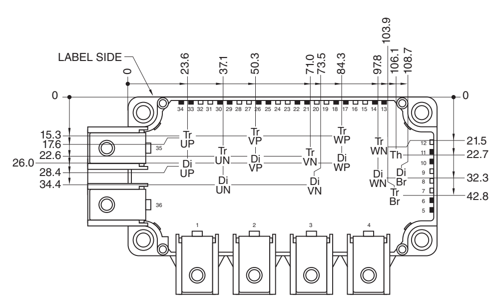
Brake Part IGBT/ClampDi

Characteristics	Symbol	Rating	Units
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 = 122°C)*2,*4	I_C	75	Amperes
Collector Current (Pulse, Repetitive)*3	I_{CRM}	150	Amperes
Total Power Dissipation (T_C = 25°C)*2,*4	P_{tot}	600	Watts
Repetitive Peak Reverse Voltage (V_{GE} = 0V)	V_{RRM}	1200	Volts
Forward Current*2	I_F*1	75	Amperes
Forward Current (Pulse, Repetitive)*3	I_{FRM}*1	150	Amperes

Module

Characteristics	Symbol	Rating	Units
Isolation Voltage (Terminals to Baseplate, RMS, f = 60Hz, AC 1 minute)	V_{ISO}	2500	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.



Each mark points to the center position of each chip.

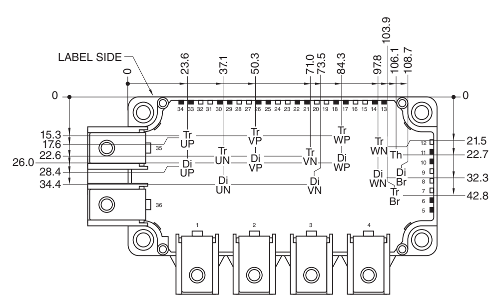
Tr*P / Tr*N / TrBr (* = U/V/W): IGBT
DiBr: Clamp
Di*P / Di*N (* = U/V/W): FWDi
Th: NTC Thermistor

Electrical Characteristics, T_j = 25°C unless otherwise specified

Inverter Part IGBT/FWDi

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 = 15mA, V_{CE} = 10V	5.4	6.0	6.6	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 150A, V_{GE} = 15V, T_j = 25°C*5	—	1.80	2.25	Volts
	(Terminal)	I_C = 150A, V_{GE} = 15V, T_j = 125°C*5	—	2.00	—	Volts
		I_C = 150A, V_{GE} = 15V, T_j = 150°C*5	—	2.05	—	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 150A, V_{GE} = 15V, T_j = 25°C*5	—	1.70	2.15	Volts
	(Chip)	I_C = 150A, V_{GE} = 15V, T_j = 125°C*5	—	1.90	—	Volts
		I_C = 150A, V_{GE} = 15V, T_j = 150°C*5	—	1.95	—	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V	—	—	15	nF
Output Capacitance	C_{oes}		—	—	3.0	nF
Reverse Transfer Capacitance	C_{res}		—	—	0.25	nF
Gate Charge	Q_G	V_{CC} = 600V, I_C = 150A, V_{GE} = 15V	—	350	—	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 150A, V_{GE} = ±15V, R_G = 0Ω, Inductive Load	—	—	800	ns
Rise Time	t_r		—	—	200	ns
Turn-off Delay Time	$t_{d(off)}$		—	—	600	ns
Fall Time	t_f		—	—	300	ns
Emitter-Collector Voltage	V_{EC}*1	I_E = 150A, V_{GE} = 0V, T_j = 25°C*5	—	1.80	2.25	Volts
	(Terminal)	I_E = 150A, V_{GE} = 0V, T_j = 125°C*5	—	1.80	—	Volts
		I_E = 150A, V_{GE} = 0V, T_j = 150°C*5	—	1.80	—	Volts
Emitter-Collector Voltage	V_{EC}*1	I_E = 150A, V_{GE} = 0V, T_j = 25°C*5	—	1.70	2.15	Volts
	(Chip)	I_E = 150A, V_{GE} = 0V, T_j = 125°C*5	—	1.70	—	Volts
		I_E = 150A, V_{GE} = 0V, T_j = 150°C*5	—	1.70	—	Volts
Reverse Recovery Time	t_{rr}*1	V_{CC} = 600V, I_E = 150A, V_{GE} = ±15V, R_G = 0Ω, Inductive Load	—	—	300	ns
Reverse Recovery Charge	Q_{rr}*1		—	8.0	—	µC
Turn-on Switching Energy per Pulse	E_{on}	V_{CC} = 600V, $I_C = I_E$ = 150A, V_{GE} = ±15V, R_G = 0Ω, T_j = 150°C, Inductive Load	—	24.2	—	mJ
Turn-off Switching Energy per Pulse	E_{off}		—	16	—	mJ
Reverse Recovery Energy per Pulse	E_{rr}*1		—	12.2	—	mJ
Internal Lead Resistance	$R_{CC'+EE'}$	Main Terminals-Chip, Per Switch, T_C = 25°C*4	—	—	1.8	mΩ
Internal Gate Resistance	r_g	Per Switch	—	13	—	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.



Each mark points to the center position of each chip.

Tr*P / Tr*N / TrBr (* = U/V/W): IGBT Di*P / Di*N (* = U/V/W): FWDi
DiBr: Clamp Th: NTC Thermistor

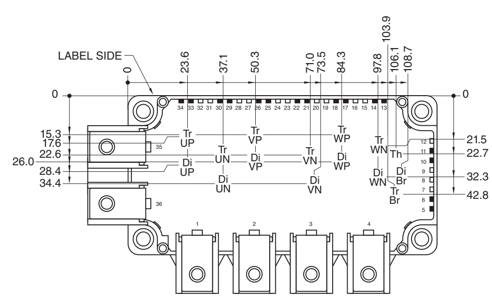
CM150RX-24S
Six IGBT + Brake NX-Series Module
150 Amperes/1200 Volts

Electrical Characteristics, T_j = 25°C unless otherwise specified

Brake Part IGBT/ClampDi

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 = 7.5mA, V_{CE} = 10V	5.4	6.0	6.6	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 75A, V_{GE} = 15V, T_j = 25°C*5	—	1.80	2.25	Volts
	(Terminal)	I_C = 75A, V_{GE} = 15V, T_j = 125°C*5	—	2.00	—	Volts
		I_C = 75A, V_{GE} = 15V, T_j = 150°C*5	—	2.05	—	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 75A, V_{GE} = 15V, T_j = 25°C*5	—	1.70	2.15	Volts
	(Chip)	I_C = 75A, V_{GE} = 15V, T_j = 125°C*5	—	1.90	—	Volts
		I_C = 75A, V_{GE} = 15V, T_j = 150°C*5	—	1.95	—	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V	—	—	7.5	nF
Output Capacitance	C_{oes}		—	—	1.5	nF
Reverse Transfer Capacitance	C_{res}		—	—	0.13	nF
Gate Charge	Q_G	V_{CC} = 600V, I_C = 75A, V_{GE} = 15V	—	175	—	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 75A, V_{GE} = ±15V,	—	—	300	ns
Rise Time	t_r	R_G = 8.2Ω, Inductive Load	—	—	200	ns
Turn-off Delay Time	$t_{d(off)}$		—	—	600	ns
Fall Time	t_f		—	—	300	ns
Repetitive Peak Reverse Current	I_{RRM}	$V_R = V_{RRM}$, V_{GE} = 0V	—	—	1.0	mA
Forward Voltage	V_F	I_E = 75A, V_{GE} = 0V, T_j = 25°C*5	—	1.80	2.25	Volts
	(Terminal)	I_E = 75A, V_{GE} = 0V, T_j = 125°C*5	—	1.80	—	Volts
		I_E = 75A, V_{GE} = 0V, T_j = 150°C*5	—	1.80	—	Volts
Forward Voltage	V_F	I_E = 75A, V_{GE} = 0V, T_j = 25°C*5	—	1.70	2.15	Volts
	(Chip)	I_E = 75A, V_{GE} = 0V, T_j = 125°C*5	—	1.70	—	Volts
		I_E = 75A, V_{GE} = 0V, T_j = 150°C*5	—	1.70	—	Volts
Reverse Recovery Time	t_{rr}*1	V_{CC} = 600V, I_E = 75A, V_{GE} = ±15V	—	—	300	ns
Reverse Recovery Charge	Q_{rr}*1	R_G = 8.2Ω, Inductive Load	—	4.0	—	µC
Turn-on Switching Energy per Pulse	E_{on}	V_{CC} = 600V, $I_C = I_E$ = 75A,	—	7.3	—	mJ
Turn-off Switching Energy per Pulse	E_{off}	V_{GE} = ±15V, R_G = 8.2Ω,	—	8.0	—	mJ
Reverse Recovery Energy per Pulse	E_{rr}*1	T_j = 150°C, Inductive Load	—	6.9	—	mJ
Internal Gate Resistance	r_g		—	0	—	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.



Each mark points to the center position of each chip.

Tr*P / Tr*N / TrBr (* = U/V/W): IGBT
DiBr: Clamp
Di*P / Di*N (* = U/V/W): FWDi
Th: NTC Thermistor

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150 Amperes/1200 Volts

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*4, R_{100} = 493Ω	-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

Thermal Resistance, Junction to Case*4	$R_{th(j-c)}Q$	Per Inverter IGBT	—	—	0.13	K/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c)}D$	Per Inverter FWDi	—	—	0.23	K/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c)}Q$	Per Brake IGBT	—	—	0.25	K/W
Thermal Resistance, Junction to Case*4	$R_{th(j-c)}D$	Per Brake ClampDi	—	—	0.40	K/W
Contact Thermal Resistance, Case to Heatsink*4	$R_{th(c-f)}$	Thermal Grease Applied, Per 1 Module*7	—	15	—	K/kW

Mechanical Characteristics

Mounting Torque	M_t	Main Terminal, M5 Screw	22	27	31	in-lb
Mounting Torque	M_s	Mounting to Heatsink, M5 Screw	22	27	31	in-lb
Creepage Distance	d_s	Terminal to Terminal	10.25	—	—	mm
		Terminal to Baseplate	12.32	—	—	mm
Clearance	d_a	Terminal to Terminal	10.28	—	—	mm
		Terminal to Baseplate	10.85	—	—	mm
Weight	m			370		g
Flatness of Baseplate	e_c	On Centerline X, Y*8	±0	—	±100	µm

Recommended Operating Conditons, T_a = 25°C

DC Supply Voltage	V_{CC}	Applied Across P-N Terminals	—	600	850	Volts
Gate-Emitter Drive Voltage	$V_{GE(on)}$	Applied Across G*P-E*P/G*N-E*N (* = U, V, W) Terminals	13.5	15.0	16.5	Volts
External Gate Resistance	R_G	Per Switch Inverter IGBT	0	—	30	Ω
		Per Switch Brake IGBT	8.2	—	82	Ω

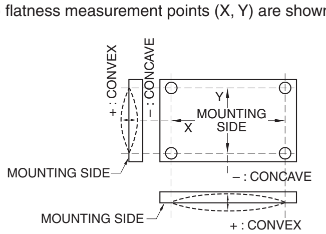
*4 Case temperature (T_C) and heatsink temperature (T_s) is measured on the surface (mounting side) of the baseplate and the heatsink side just under the chips. Refer to the figure to the right for chip location. The heatsink thermal resistance should be measured just under the chips.

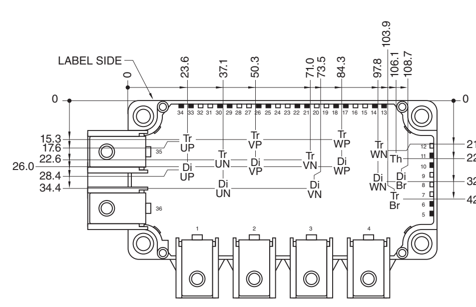
*6 $B_{(25/50)} = \ln(\frac{R_{25}}{R_{50}})/(\frac{1}{T_{25}} - \frac{1}{T_{50}})$

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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Tr*P / Tr*N / TrBr (* = U/V/W): IGBT Di*P / Di*N (* = U/V/W): FWDi
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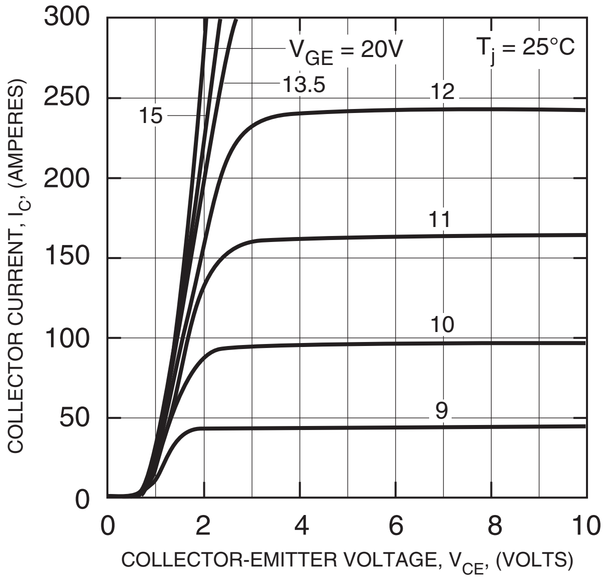
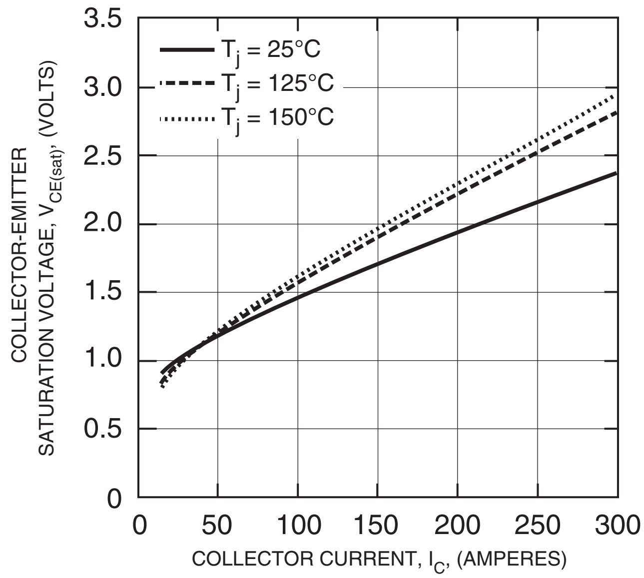
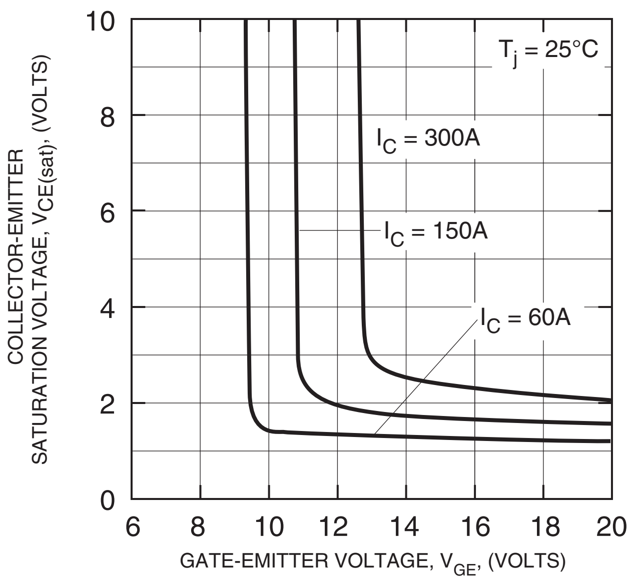
OUTPUT CHARACTERISTICS
(INVERTER PART - TYPICAL)



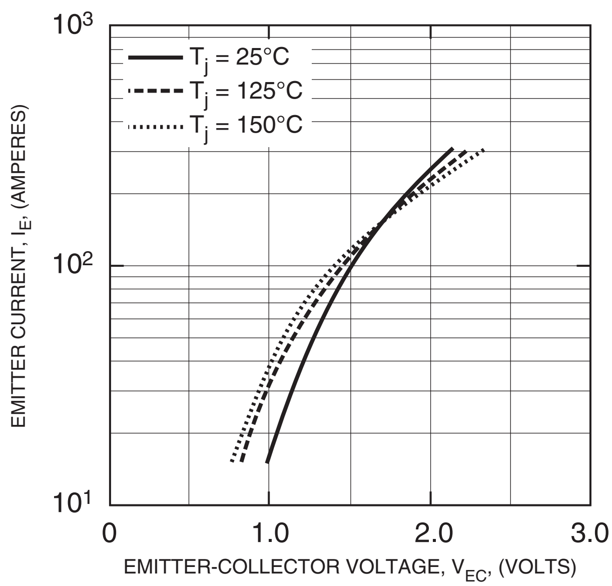
COLLECTOR-EMITTER
SATURATION VOLTAGE CHARACTERISTICS
(INVERTER PART - TYPICAL)



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



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



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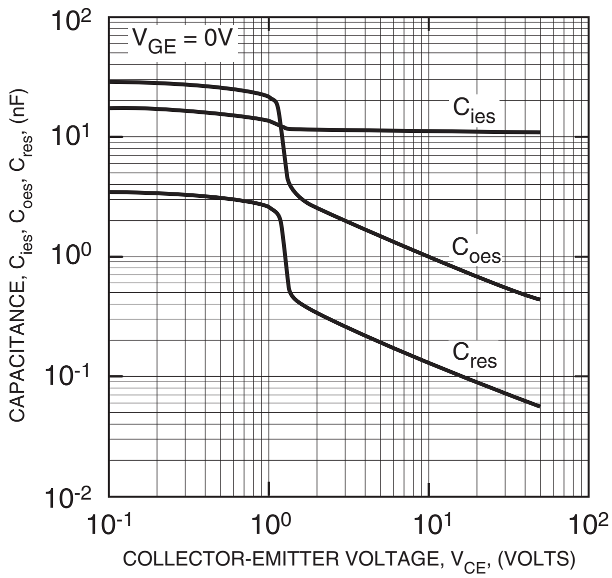
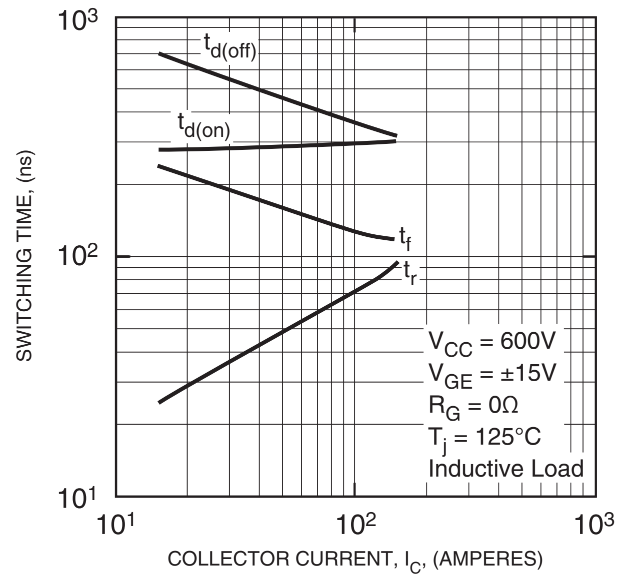
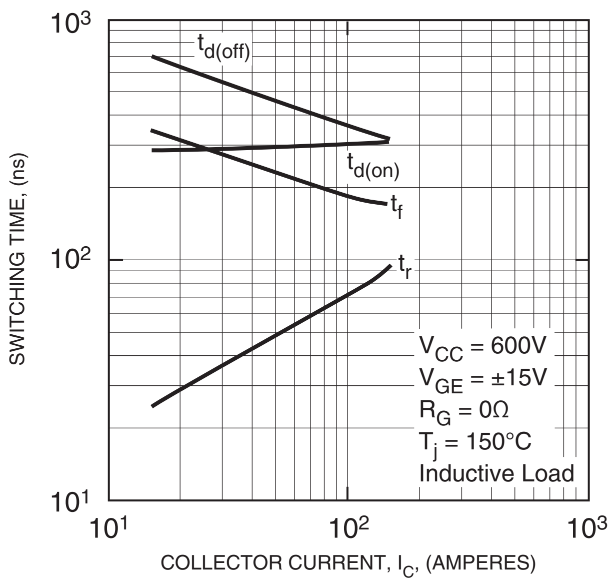
CAPACITANCE VS. V_{CE} (INVERTER PART - TYPICAL)



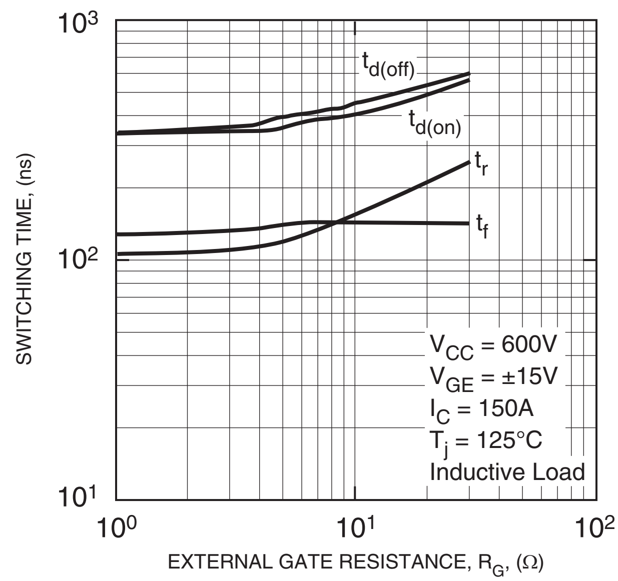
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



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



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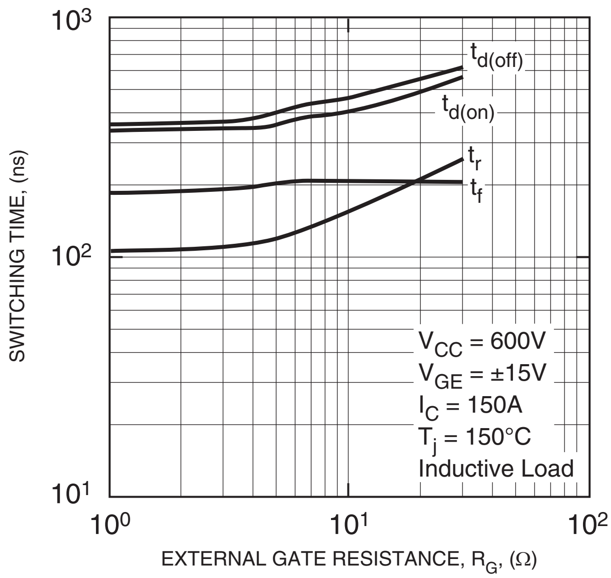
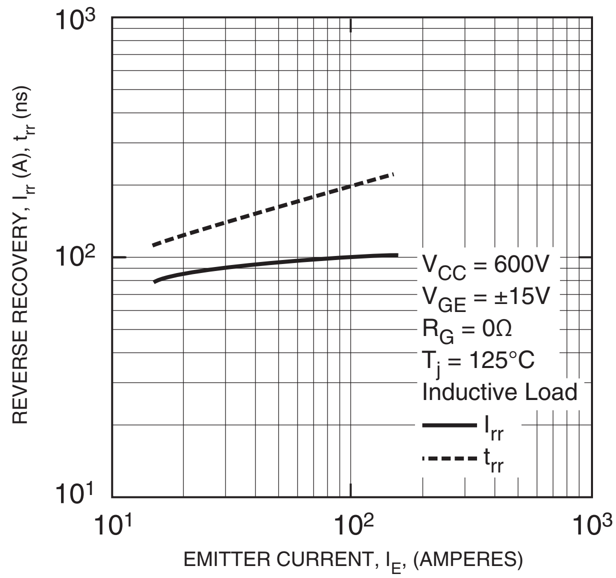
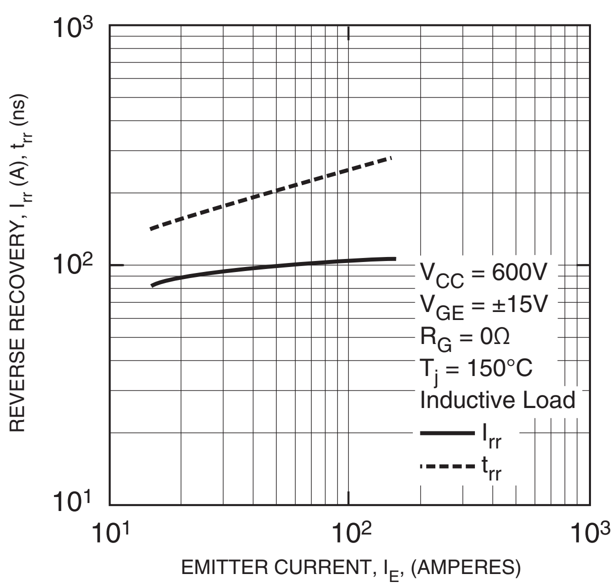
SWITCHING TIME VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



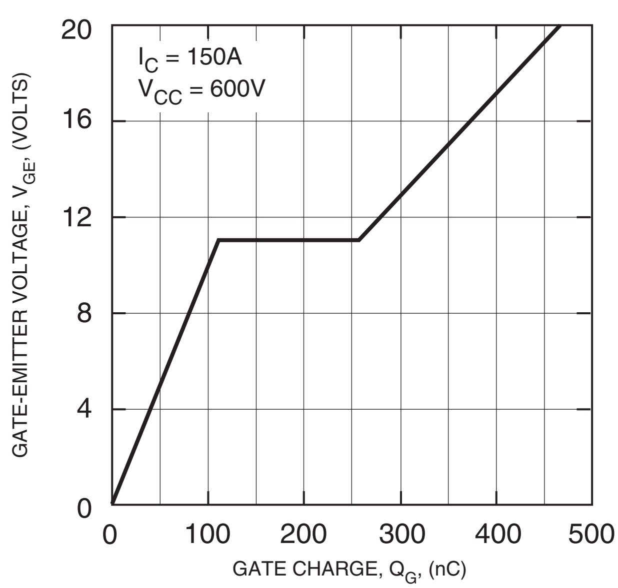
REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (INVERTER PART - TYPICAL)



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



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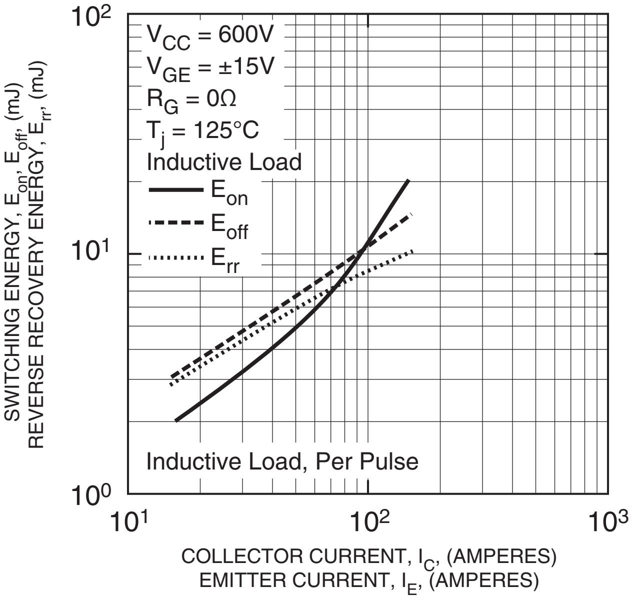
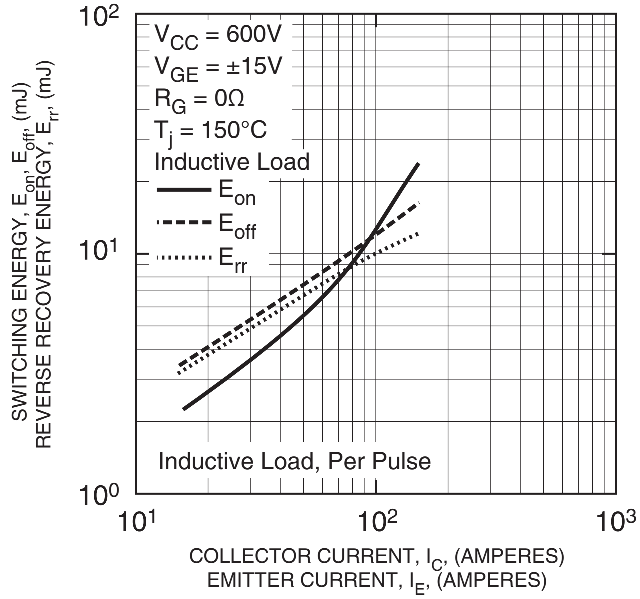
Six IGBT + Brake NX-Series Module
150 Amperes/1200 Volts

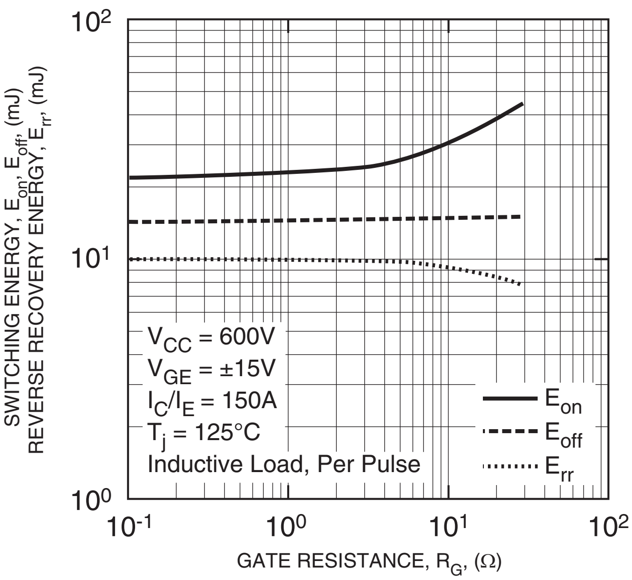
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



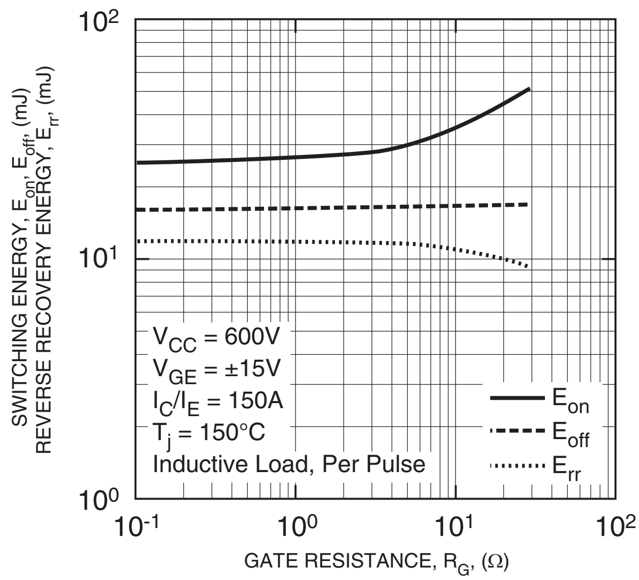
HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (INVERTER PART - TYPICAL)



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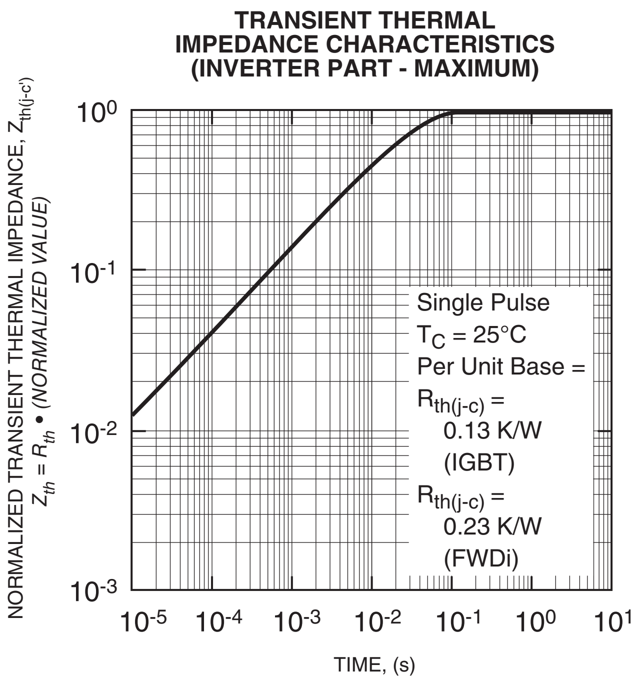

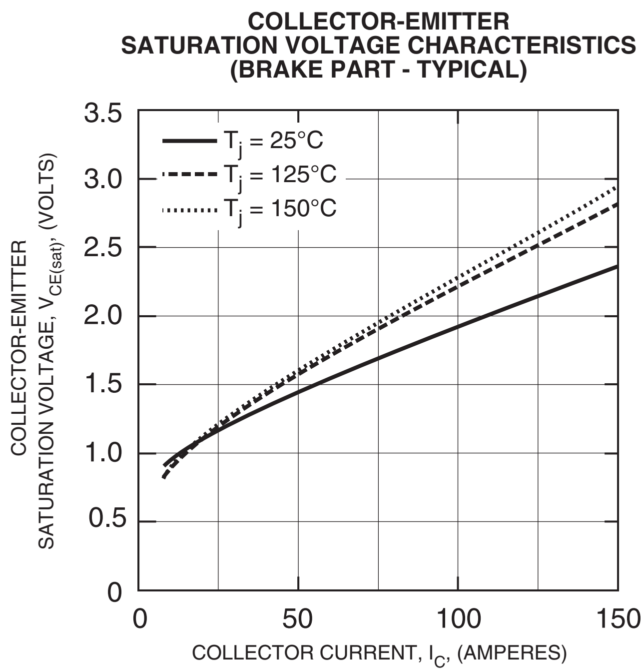

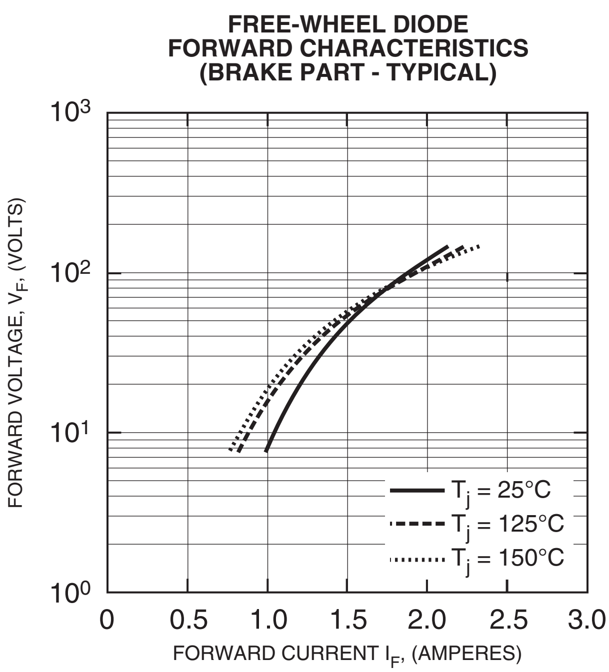

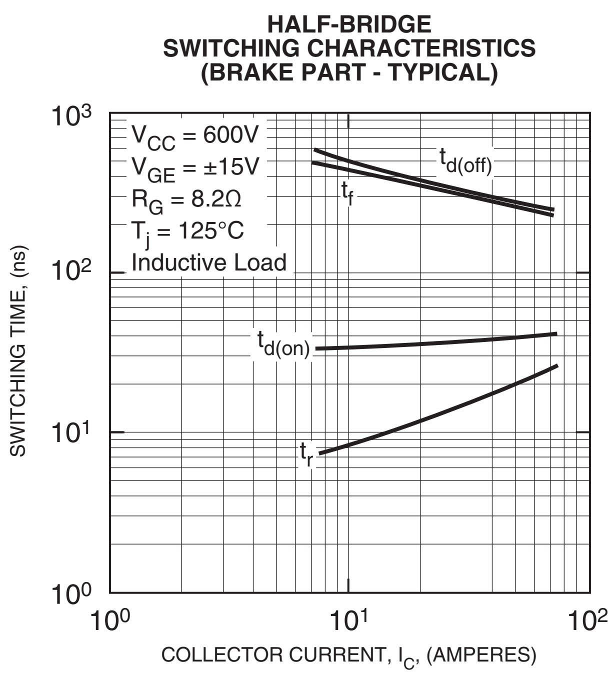

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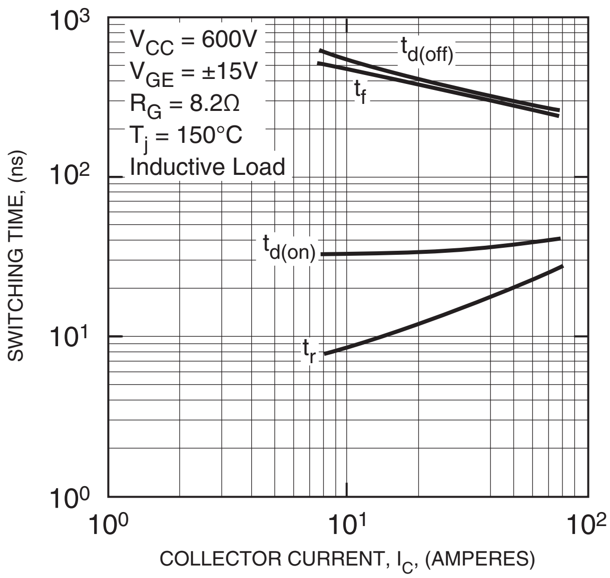
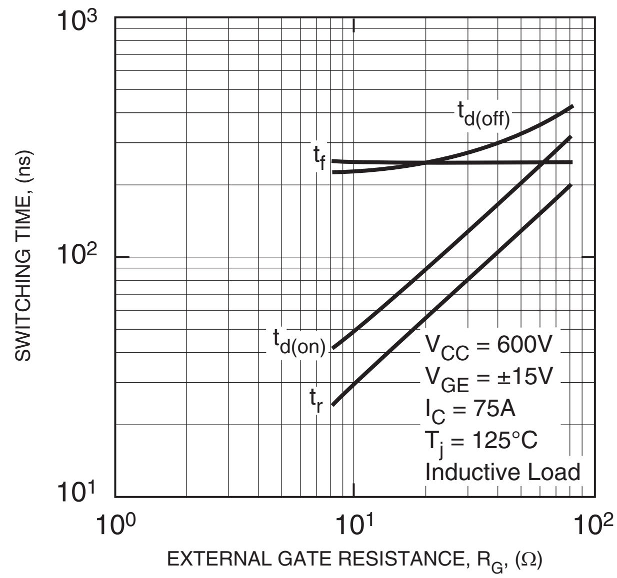
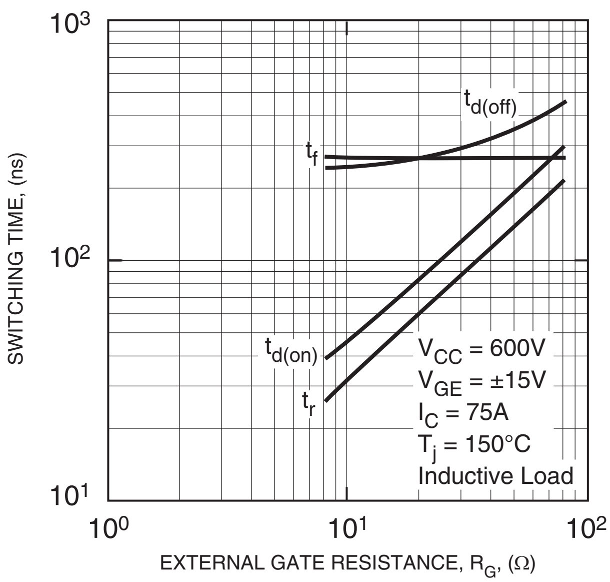
HALF-BRIDGE SWITCHING CHARACTERISTICS (BRAKE PART - TYPICAL)



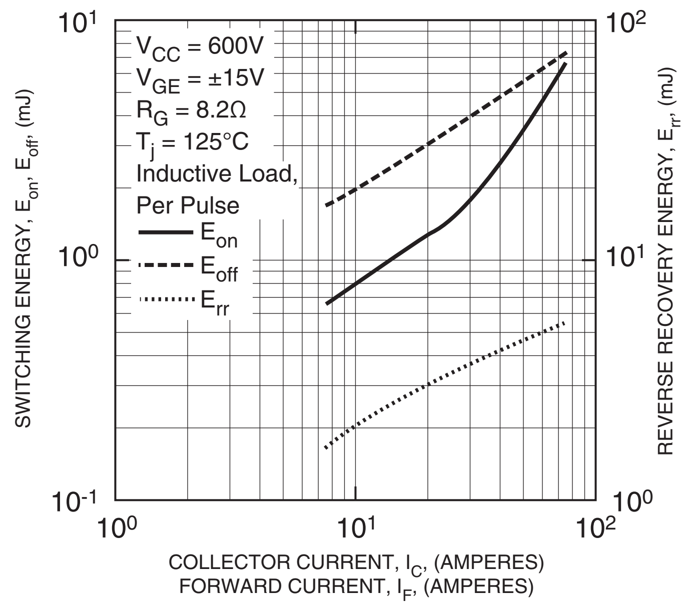
SWITCHING TIME VS. GATE RESISTANCE (BRAKE - TYPICAL)



SWITCHING TIME VS. GATE RESISTANCE (BRAKE - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (BRAKE PART - TYPICAL)



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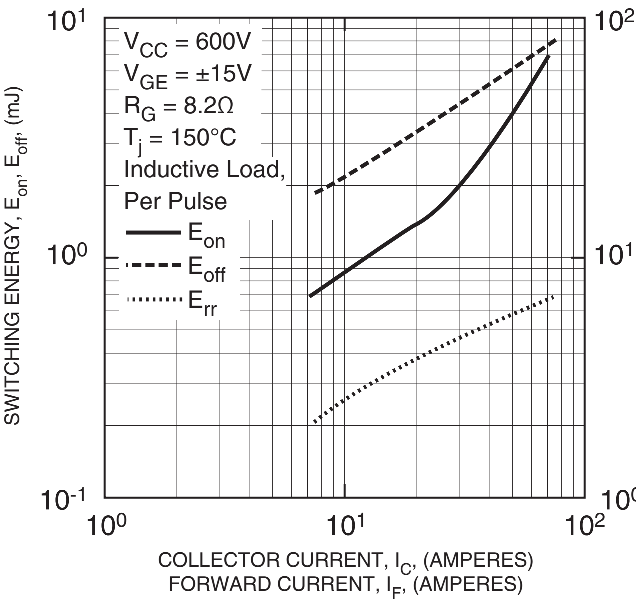
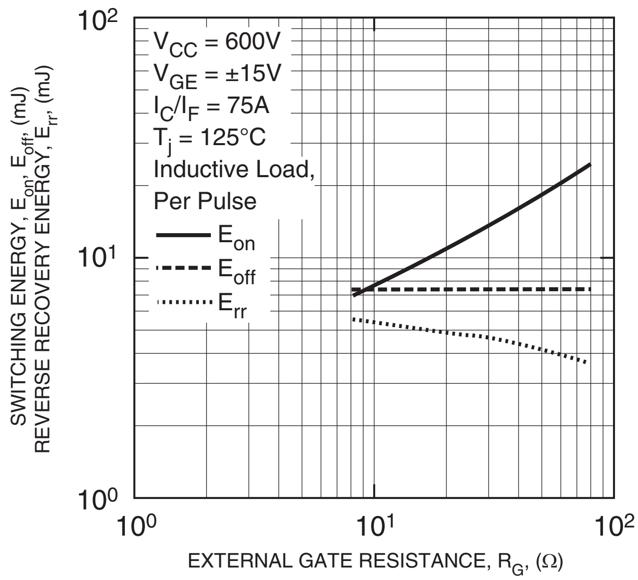
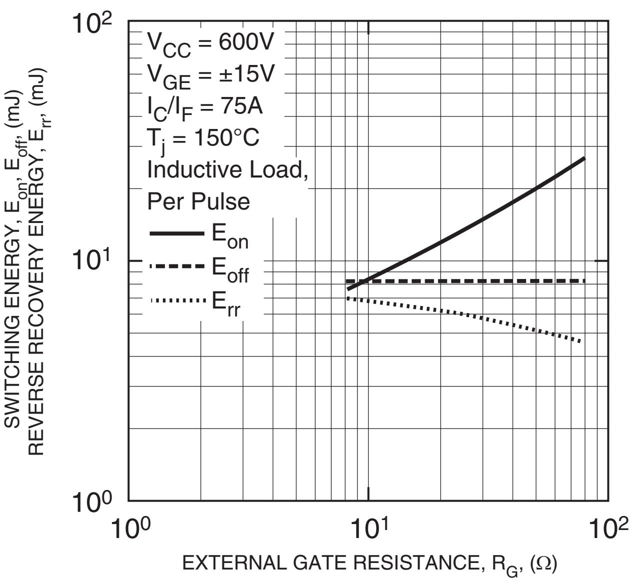
HALF-BRIDGE SWITCHING CHARACTERISTICS (BRAKE PART - TYPICAL)



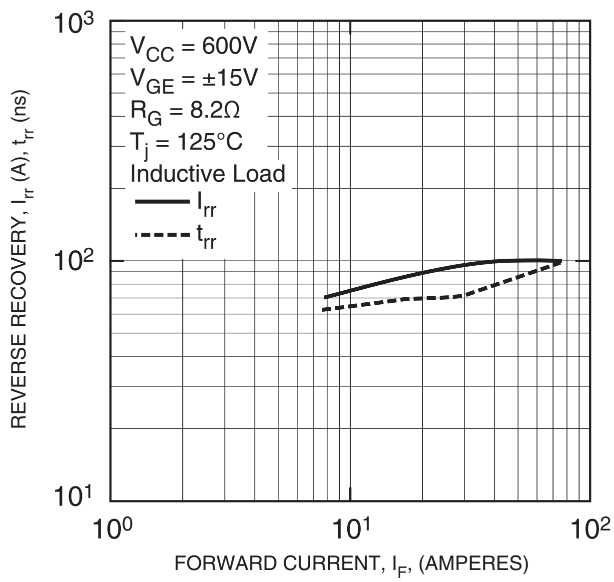
HALF-BRIDGE SWITCHING CHARACTERISTICS (BRAKE PART - TYPICAL)



HALF-BRIDGE SWITCHING CHARACTERISTICS (BRAKE PART - TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (BRAKE PART - TYPICAL)



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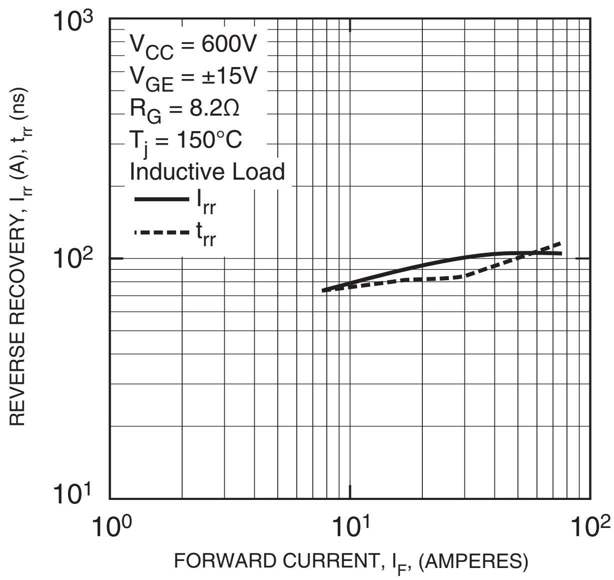
REVERSE RECOVERY CHARACTERISTICS (BRAKE PART - TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (BRAKE PART - MAXIMUM)