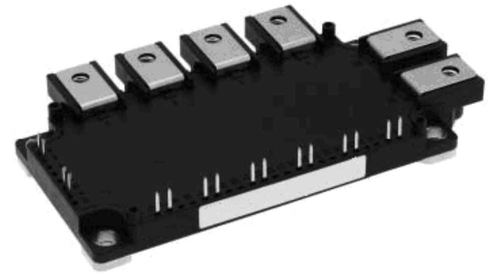
CM75RX-24S



sevenpack (3φ inverter+Brake)

- 6th Generation NX series -

Collector current I_C .... **7 5** A

Collector-emitter voltage V_{CES} .... **1 2 0 0** V

Maximum junction temperature T_{jmax} ... **1 7 5** °C

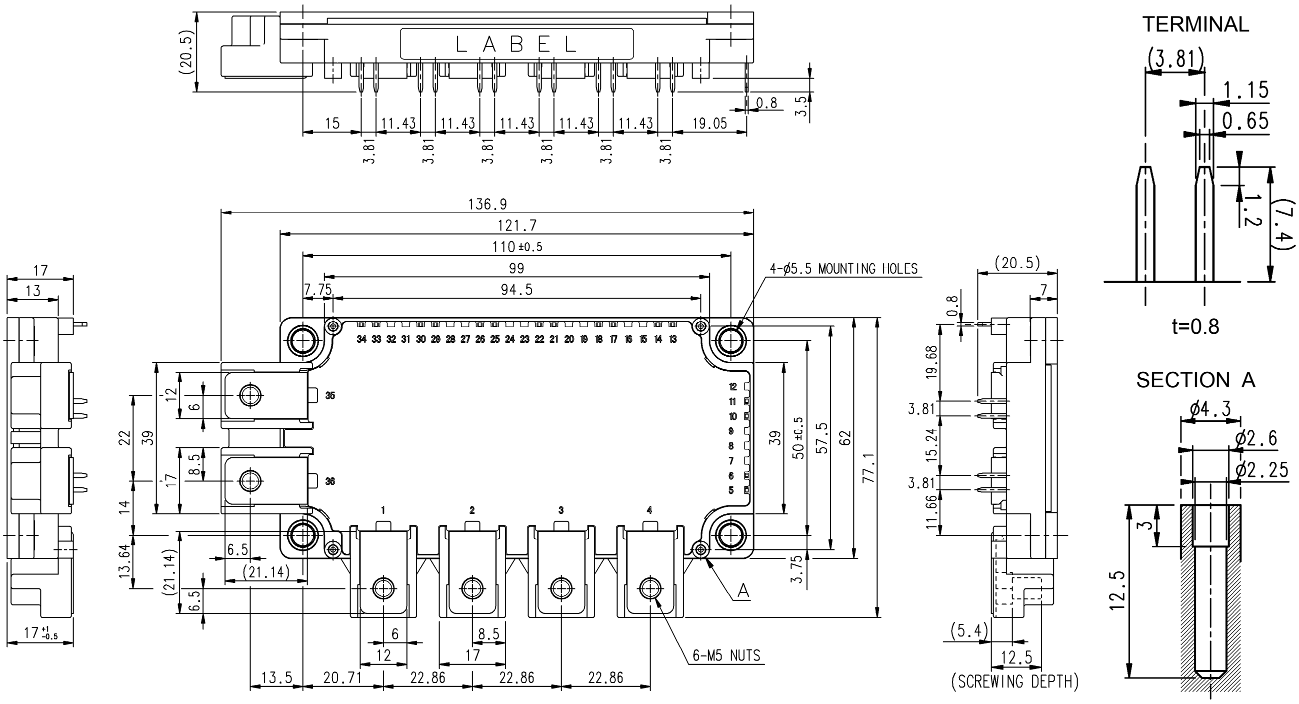
- Flat base Type
- Copper base plate (non-plating)
- Tin plating pin terminals
- RoHS Directive compliant
- UL Recognized under UL1557, File E323585

APPLICATION

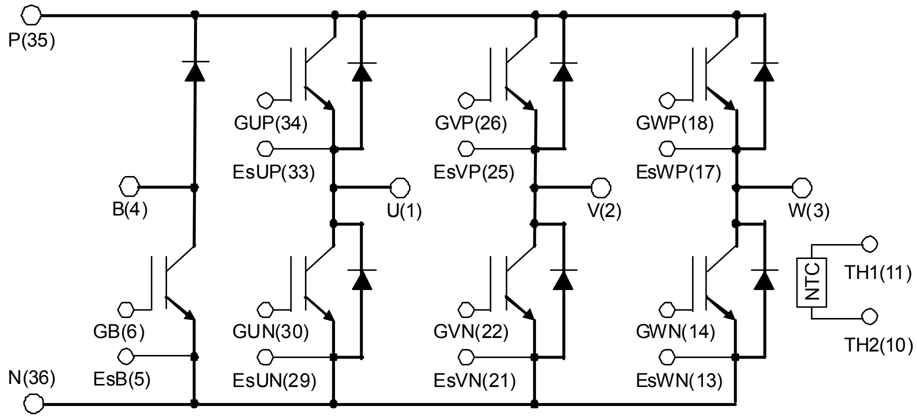
AC Motor Control, Motion/Servo Control, etc.

OUTLINE DRAWING & INTERNAL CONNECTION

Dimension in mm



INTERNAL CONNECTION



Tolerance otherwise specified

Division of Dimension			Tolerance
	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 be ±0.4.

Apr. 2011

MITSUBISHI ELECTRIC

ABSOLUTE MAXIMUM RATINGS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/FWDi

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	±20	V
I_C	Collector current	DC, T_C=122 °C (Note.2)	75	A
I_{CRM}		Pulse (Note.3)	150	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 4)	600	W
I_E (Note.1)	Emitter current	T_C=25 °C (Note.2, 4)	75	A
I_{ERM} (Note.1)		Pulse (Note.3)	150	

BRAKE PART IGBT/CLAMPDi

Symbol	Item	Conditions	Rating	Unit
V_{CES}	Collector-emitter voltage	G-E short-circuited	1200	V
V_{GES}	Gate-emitter voltage	C-E short-circuited	±20	V
I_C	Collector current	DC, T_C=125 °C (Note.2)	50	A
I_{CRM}		Pulse (Note.3)	100	
P_{tot}	Total power dissipation	T_C=25 °C (Note.2, 4)	425	W
V_{RRM}	Repetitive peak reverse voltage	G-E short-circuited	1200	V
I_F (Note.1)	Forward current	T_C=25 °C (Note.2, 4)	50	A
I_{FRM} (Note.1)		Pulse (Note.3)	100	

MODULE

Symbol	Item	Conditions	Rating	Unit
T_{jmax}	Maximum junction temperature	-	175	°C
T_{Cmax}	Maximum case temperature	(Note.2)	125	
T_{jop}	Operating junction temperature	-	-40 ~ +150	°C
T_{stg}	Storage temperature	-	-40 ~ +125	
V_{isol}	Isolation voltage	Terminals to base plate, RMS, f=60 Hz, AC 1 min	2500	V

ELECTRICAL CHARACTERISTICS (T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/FWDi

Symbol	Item	Conditions		Limits Min.	Typ.	Max.	Unit
I_{CES}	Collector-emitter cut-off current	V_{CE}=V_{CES}, G-E short-circuited		-	-	1	mA
I_{GES}	Gate-emitter leakage current	V_{GE}=V_{GES}, C-E short-circuited		-	-	0.5	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=7.5 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	I_C=75 A (Note.5), V_{GE}=15 V	T_j=25 °C	-	1.80	2.25	V
			T_j=125 °C	-	2.00	-	
			T_j=150 °C	-	2.05	-	
V_{CEsat} (Chip)	Collector-emitter saturation voltage	I_C=75 A (Note.5), V_{GE}=15 V	T_j=25 °C	-	1.70	2.15	V
			T_j=125 °C	-	1.90	-	
			T_j=150 °C	-	1.95	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	7.5	nF
C_{oes}	Output capacitance			-	-	1.5	
C_{res}	Reverse transfer capacitance			-	-	0.13	
Q_G	Gate charge	V_{CC}=600 V, I_C=75 A, V_{GE}=15 V		-	175	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=75 A, V_{GE}=±15 V, R_G=8.2 Ω, Inductive load		-	-	300	ns
t_r	Rise time			-	-	200	
$t_{d(off)}$	Turn-off delay time			-	-	600	
t_f	Fall time			-	-	300	
V_{EC} (Note.1) (Terminal)	Emitter-collector voltage	I_E=75 A (Note.5), G-E short-circuited	T_j=25 °C	-	1.8	2.25	V
			T_j=125 °C	-	1.8	-	
			T_j=150 °C	-	1.8	-	
V_{EC} (Note.1) (Chip)	Emitter-collector voltage	I_E=75 A (Note.5), G-E short-circuited	T_j=25 °C	-	1.7	2.15	V
			T_j=125 °C	-	1.7	-	
			T_j=150 °C	-	1.7	-	

ELECTRICAL CHARACTERISTICS (cont.; T_j=25 °C, unless otherwise specified)

INVERTER PART IGBT/FWDi

Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
t_{rr} (Note.1)	Reverse recovery time	V_{CC}=600 V, I_E=75 A, V_{GE}=±15 V, R_G=8.2 Ω, Inductive load	-	-	300	ns
Q_{rr} (Note.1)	Reverse recovery charge		-	4.0	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_E=75 A, V_{GE}=±15 V, R_G=8.2 Ω, T_j=150 °C, Inductive load	-	7.3	-	mJ
E_{off}	Turn-off switching energy per pulse		-	8.0	-	
E_{rr} (Note.1)	Reverse recovery energy per pulse		-	6.9	-	mJ
$R_{CC'+EE'}$	Internal lead resistance	Main terminals-chip, per switch, T_C=25 °C (Note.2)	-	-	2.4	mΩ
r_g	Internal gate resistance	Per switch	-	0	-	Ω

BRAKE PART IGBT/CLAMPDi

Symbol	Item	Conditions		Limits Min.	Limits Typ.	Limits Max.	Unit
I_{CES}	Collector-emitter cut-off current	V_{CE}=V_{CES}, G-E short-circuited		-	-	1	mA
I_{GES}	Gate-emitter leakage current	V_{GE}=V_{GES}, C-E short-circuited		-	-	0.5	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	I_C=5 mA, V_{CE}=10 V		5.4	6.0	6.6	V
V_{CEsat} (Terminal)	Collector-emitter saturation voltage	I_C=50 A (Note.5), V_{GE}=15 V	T_j=25 °C	-	1.80	2.25	V
			T_j=125 °C	-	2.00	-	
			T_j=150 °C	-	2.05	-	
V_{CEsat} (Chip)	Collector-emitter saturation voltage	I_C=50 A (Note.5), V_{GE}=15 V	T_j=25 °C	-	1.70	2.15	V
			T_j=125 °C	-	1.90	-	
			T_j=150 °C	-	1.95	-	
C_{ies}	Input capacitance	V_{CE}=10 V, G-E short-circuited		-	-	5.0	nF
C_{oes}	Output capacitance			-	-	1.0	
C_{res}	Reverse transfer capacitance			-	-	0.08	
Q_G	Gate charge	V_{CC}=600 V, I_C=50 A, V_{GE}=15 V		-	117	-	nC
$t_{d(on)}$	Turn-on delay time	V_{CC}=600 V, I_C=50 A, V_{GE}=±15 V, R_G=13 Ω, Inductive load		-	-	300	ns
t_r	Rise time			-	-	200	
$t_{d(off)}$	Turn-off delay time			-	-	600	
t_f	Fall time			-	-	300	
I_{RRM}	Repetitive peak reverse current	V_R=V_{RRM}, G-E short-circuited		-	-	1	mA
V_F (Terminal)	Forward voltage	I_F=50 A (Note.5), G-E short-circuited	T_j=25 °C	-	1.8	2.25	V
			T_j=125 °C	-	1.8	-	
			T_j=150 °C	-	1.8	-	
V_F (Chip)	Forward voltage	I_F=50 A (Note.5), G-E short-circuited	T_j=25 °C	-	1.7	2.15	V
			T_j=125 °C	-	1.7	-	
			T_j=150 °C	-	1.7	-	
t_{rr}	Reverse recovery time	V_{CC}=600 V, I_F=50 A, V_{GE}=±15 V, R_G=13 Ω, Inductive load		-	-	300	ns
Q_{rr}	Reverse recovery charge			-	2.7	-	μC
E_{on}	Turn-on switching energy per pulse	V_{CC}=600 V, I_C=I_F=50 A, V_{GE}=±15 V, R_G=13 Ω, T_j=150 °C, Inductive load		-	5.5	-	mJ
E_{off}	Turn-off switching energy per pulse			-	5.3	-	
E_{rr}	Reverse recovery energy per pulse			-	4.5	-	mJ
r_g	Internal gate resistance	-		-	0	-	Ω

NTC THERMISTOR PART

Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
R_{25}	Zero power resistance	T_C=25 °C (Note.2)	4.85	5.00	5.15	kΩ
ΔR/R	Deviation of resistance	T_C=100 °C, R_{100}=493 Ω	-7.3	-	+7.8	%
$B_{(25/50)}$	B constant	Approximate by equation (Note.6)	-	3375	-	K
P_{25}	Power dissipation	T_C=25 °C (Note.2)	-	-	10	mW

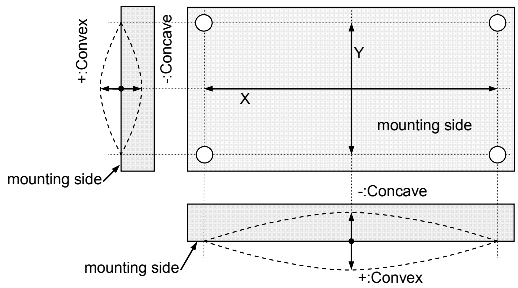
THERMAL RESISTANCE CHARACTERISTICS

Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
$R_{th(j-c)Q}$	Thermal resistance (Note. 2)	Junction to case, per Inverter IGBT	-	-	0.25	K/W
$R_{th(j-c)D}$		Junction to case, per Inverter FWDi	-	-	0.40	
$R_{th(j-c)Q}$		Junction to case, per Brake IGBT	-	-	0.35	K/W
$R_{th(j-c)D}$		Junction to case, per Brake ClampDi	-	-	0.63	
$R_{th(c-s)}$	Contact thermal resistance (Note.2)	Case to heat sink, per 1 module, Thermal grease applied (Note.7)	-	15	-	K/kW

MECHANICAL CHARACTERISTICS

Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
M_t	Mounting torque	Main Terminals M 5 screw	2.5	3.0	3.5	N·m
M_s		Mounting to heat sink M 5 screw	2.5	3.0	3.5	
d_s	Creepage distance	Terminal to terminal	10.25	-	-	mm
		Terminal to base plate	12.32	-	-	
d_a	Clearance	Terminal to terminal	10.28	-	-	mm
		Terminal to base plate	10.85	-	-	
m	Weight	-	-	370	-	g
e_c	Flatness of base plate	On the centerline X, Y (Note.8)	±0	-	+100	μm

Note.1: Represent ratings and characteristics of the anti-parallel, emitter-collector free wheeling diode (FWDi).
Note.2: Case temperature (T_C) and heat sink temperature (T_s) are defined on the each surface of base plate and heat sink just under the chips. Refer to the figure of chip location.
The heat sink thermal resistance should measure just under the chips.
Note.3: Pulse width and repetition rate should be such that the device junction temperature (T_j) dose not exceed T_{jmax} rating.
Note.4: Junction temperature (T_j) should not increase beyond T_{jmax} rating.
Note.5: Pulse width and repetition rate should be such as to cause negligible temperature rise.
Refer to the figure of test circuit for V_{CEsat}, V_{EC} and ClampDi V_F.
Note.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]
Note.7: Typical value is measured by using thermally conductive grease of λ=0.9 W/(m·K).
Note.8: The base plate (mounting side) flatness measurement points (X, Y) are as follows of the following figure.



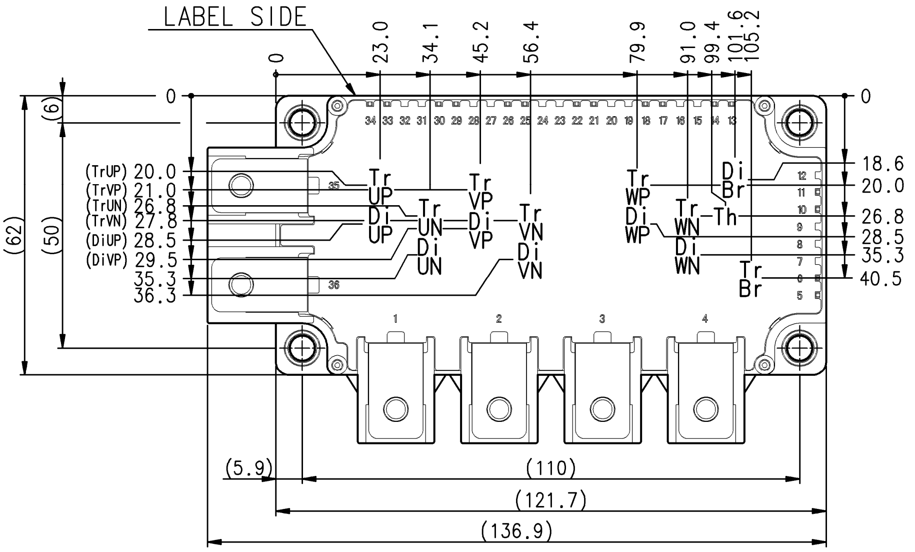
Note.9: Japan Electronics and Information Technology Industries Association (JEITA) standards,
"EIAJ ED-4701/300: Environmental and endurance test methods for semiconductor devices (Stress test I)"
Note.10: Use the following screws when mounting the printed circuit board (PCB) on the stand offs.
"M2.6×10 or M2.6×12 self tapping screw"
The length of the screw depends on the thickness of the PCB.

RECOMMENDED OPERATING CONDITIONS (T_a=25 °C, unless otherwise specified)

Symbol	Item	Conditions	Limits Min.	Limits Typ.	Limits Max.	Unit
V_{CC}	DC supply voltage	Applied across P-N terminals	-	600	850	V
V_{GEon}	Gate (-emitter drive) voltage	Applied across GB-EsB / G*P-Es*P / G*N-Es*N terminals	13.5	15.0	16.5	V
R_G	External gate resistance	Per switch — Inverter IGBT	8.2	-	82	Ω
		Per switch — Brake IGBT	13	-	130	

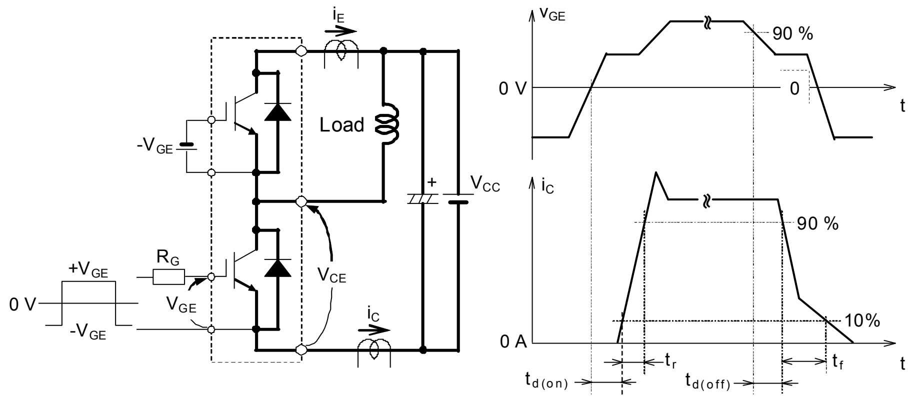
CHIP LOCATION (top view)

Dimension in mm, Tolerance: ±1 mm

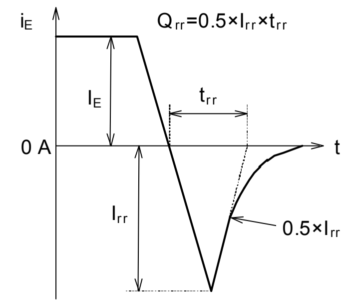


Tr*P/Tr*N/TrBr: IGBT, Di*P/Di*N: FWDi, DiBr: ClampDi, Th: NTC thermistor.

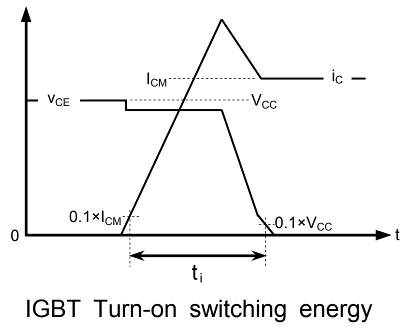
TEST CIRCUIT AND WAVEFORMS



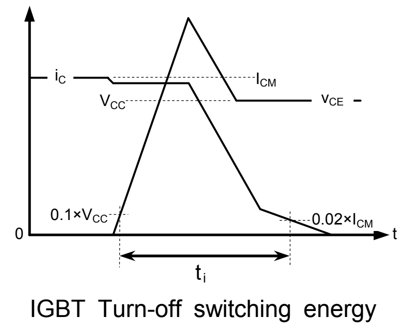
Switching characteristics test circuit and waveforms



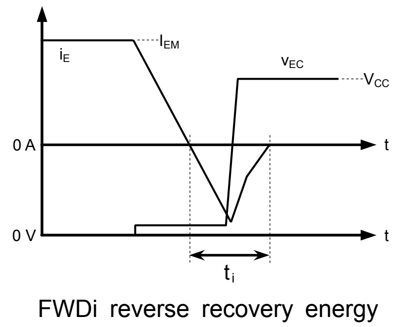
t_{rr}, Q_{rr} test waveform



IGBT Turn-on switching energy



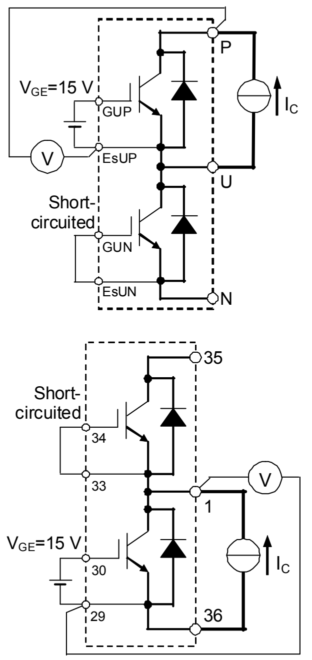
IGBT Turn-off switching energy



FWDi reverse recovery energy

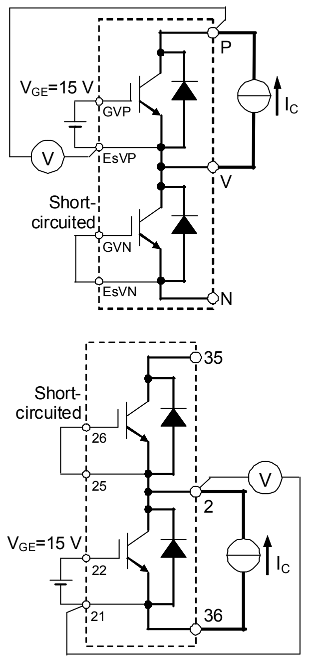
Turn-on / Turn-off switching energy and Reverse recovery energy test waveforms (Integral time instruction drawing)

TEST CIRCUIT



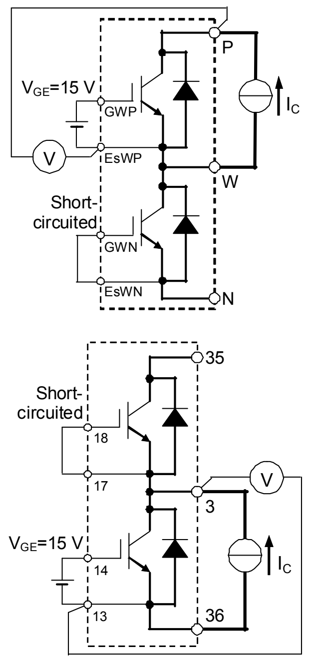
Gate-emitter short-circuited GVP-EsVP GVN-EsVN, GWP-EsWP, GWN-EsWN, GB-EsB

UP / UN IGBT



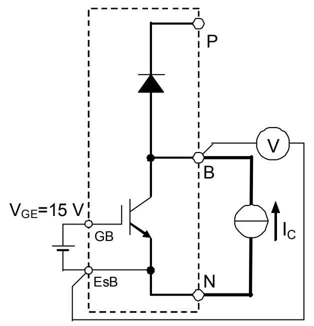
Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GWP-EsWP, GWN-EsWN, GB-EsB

VP / VN IGBT



Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GVP-EsVP, GVN-EsVN, GB-EsB

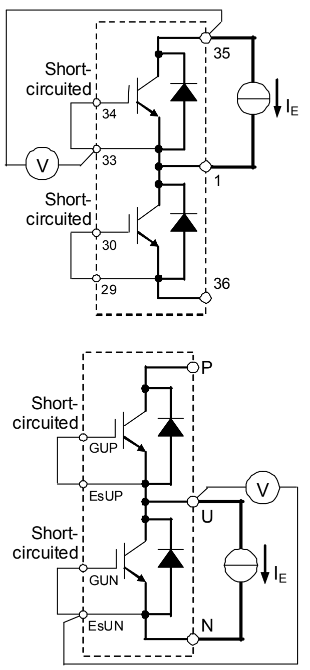
WP / WN IGBT



Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GVP-EsVP, GVN-EsVN, GWP-EsWP, GWN-EsWN

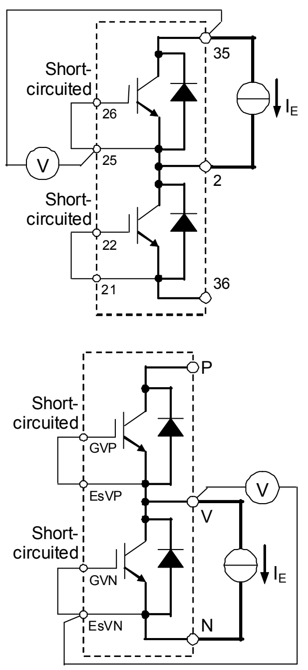
Brake IGBT

V_{CEsat} test circuit



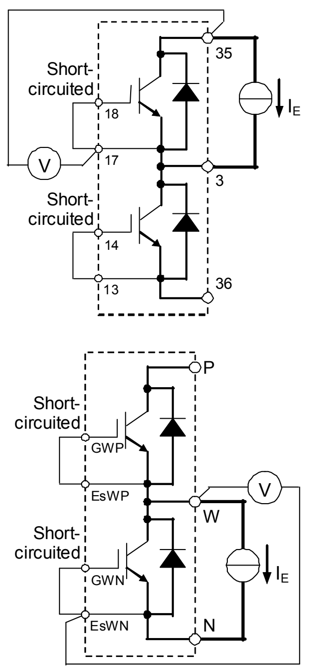
Gate-emitter short-circuited GVP-EsVP GVN-EsVN, GWP-EsWP, GWN-EsWN, GB-EsB

UP / UN FWDi



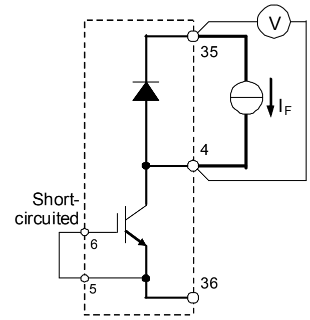
Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GWP-EsWP, GWN-EsWN, GB-EsB

VP / VN FWDi



Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GVP-EsVP, GVN-EsVN, GB-EsB

WP / WN FWDi



Gate-emitter short-circuited GUP-EsUP, GUN-EsUN, GVP-EsVP, GVN-EsVN, GWP-EsWP, GWN-EsWN

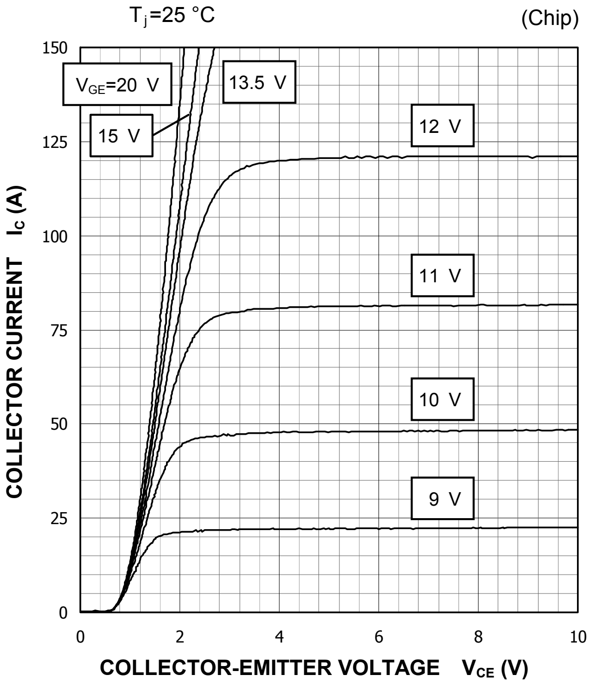
Brake ClampDi

V_{EC} / V_F test circuit

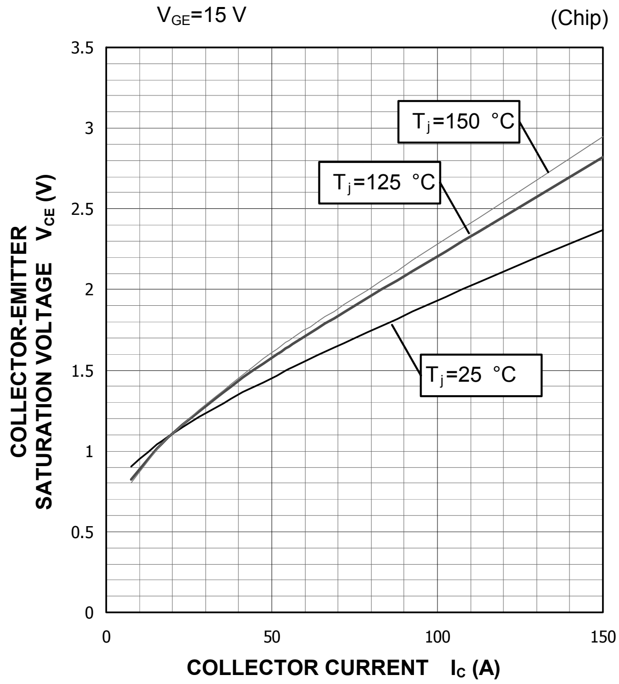
PERFORMANCE CURVES

INVERTER PART

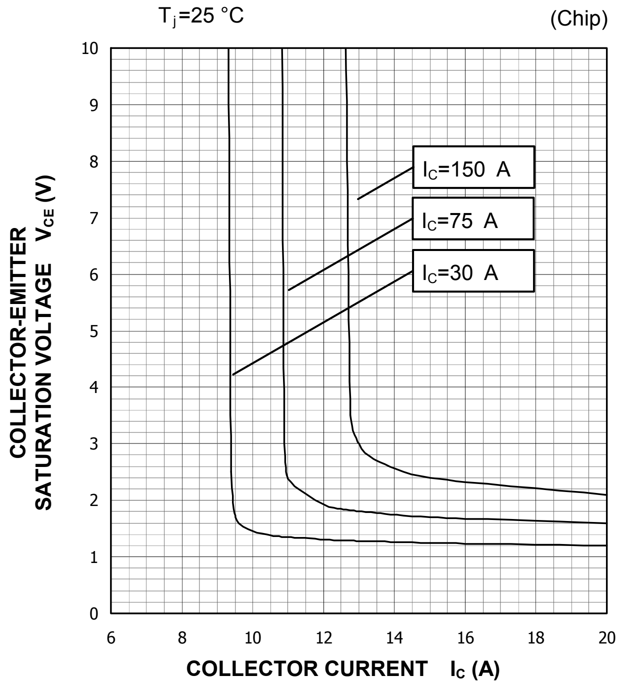
OUTPUT CHARACTERISTICS
(TYPICAL)



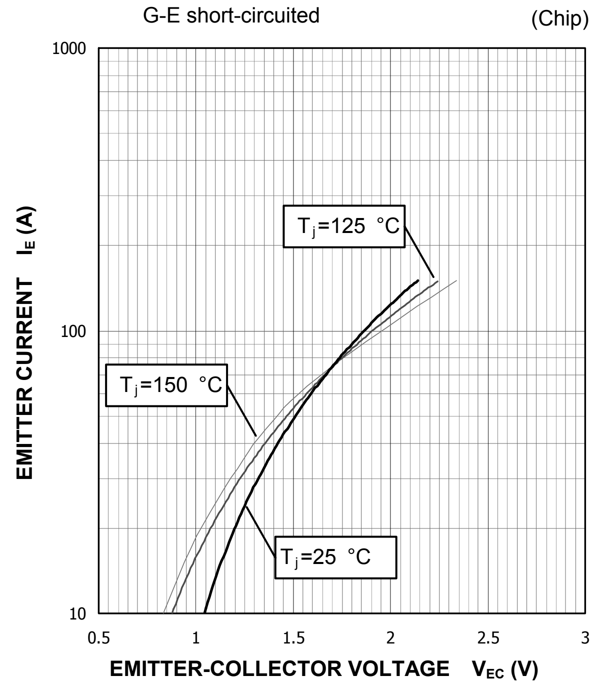
COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)



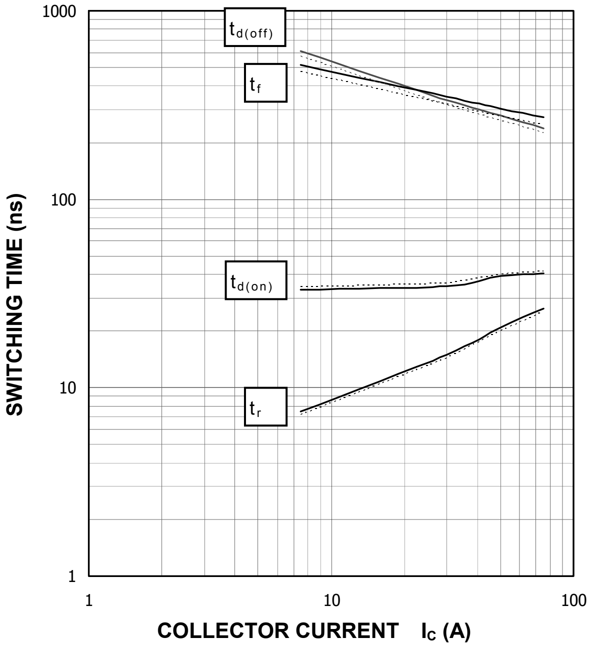
COLLECTOR-EMITTER SATURATION VOLTAGE
CHARACTERISTICS
(TYPICAL)



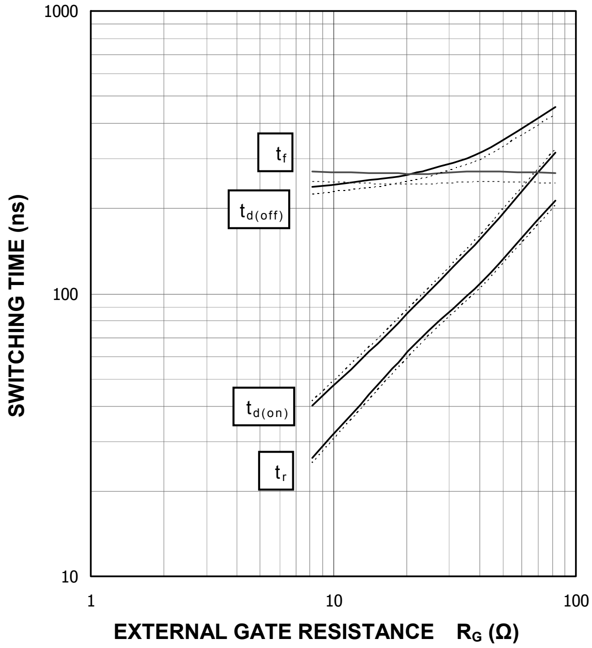
FREE WHEELING DIODE
FORWARD CHARACTERISTICS
(TYPICAL)



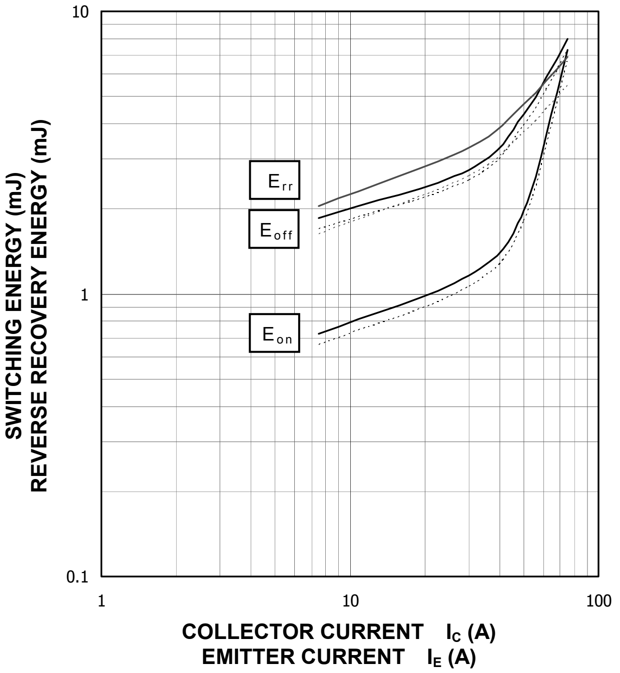
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=8.2 Ω,
———: T_j=150 °C, - - - - -: T_j=125 °C



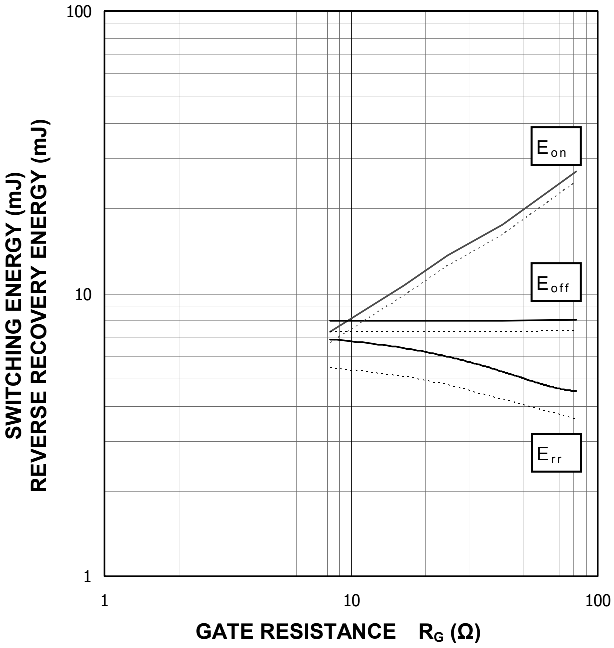
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, IC=75 A,
———: T_j=150 °C, - - - - -: T_j=125 °C



HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=8.2 Ω,
———: T_j=150 °C, - - - - -: T_j=125 °C

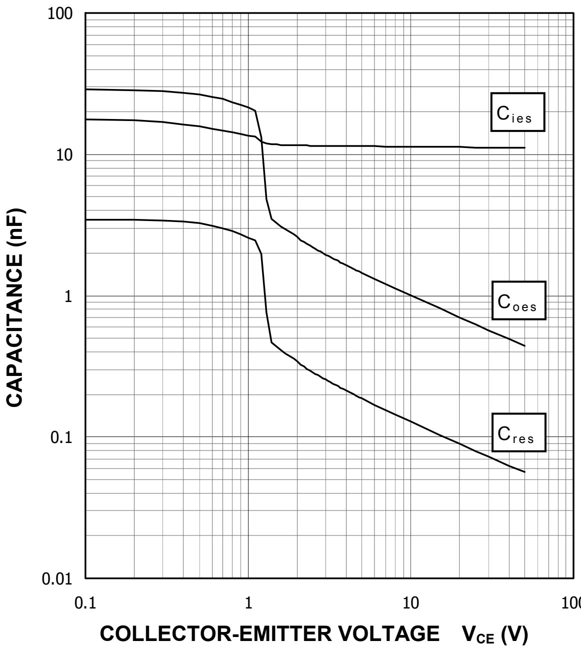


HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, I_C=75 A,
———: T_j=150 °C, - - - - -: T_j=125 °C



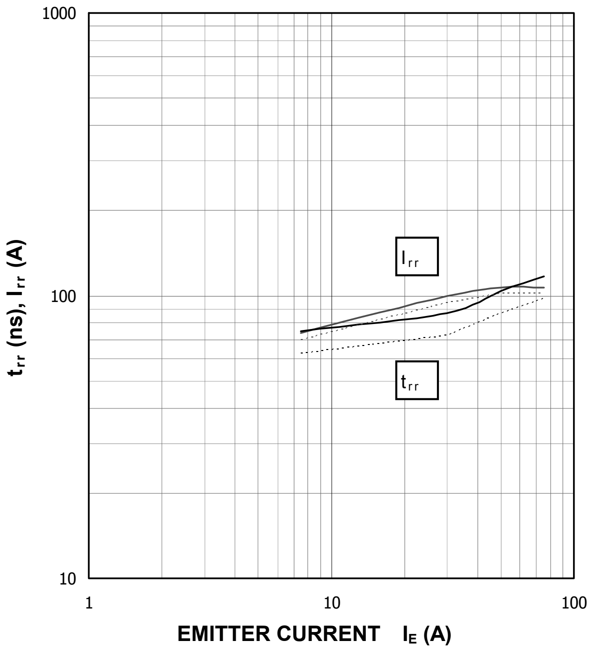
CAPACITANCE CHARACTERISTICS (TYPICAL)

G-E short-circuited, T_j=25 °C



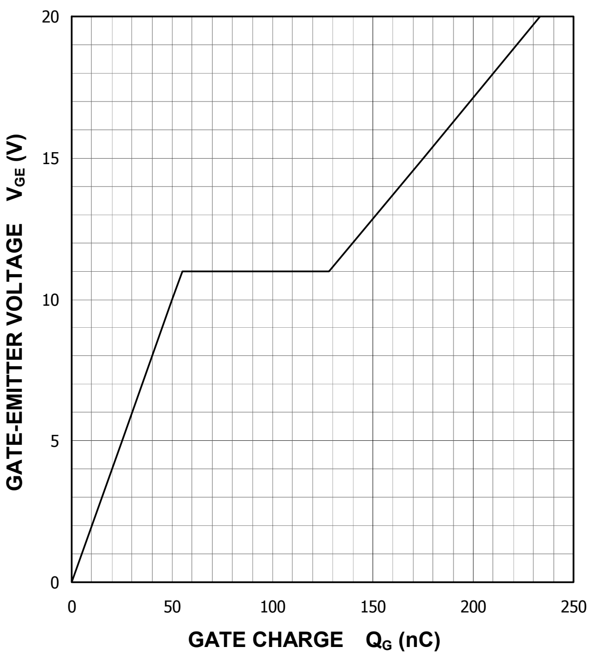
FREE WHEELING DIODE REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=8.2 Ω,
———: T_j=150 °C, - - - - -: T_j=125 °C



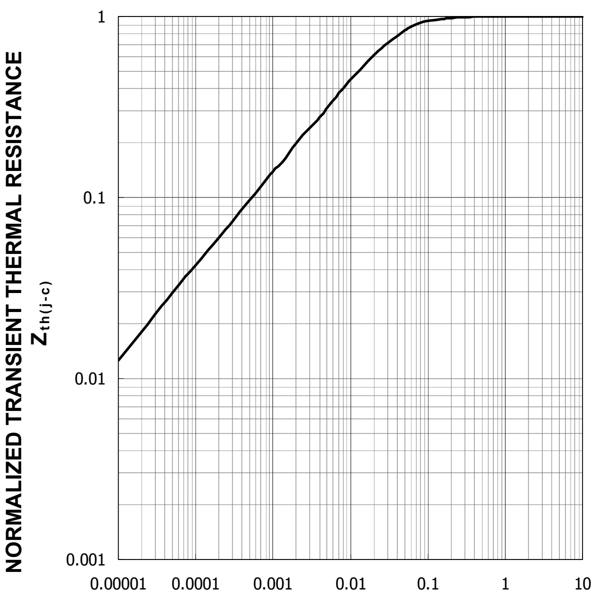
GATE CHARGE CHARACTERISTICS (TYPICAL)

I_C=75 A, T_j=25 °C



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (MAXIMUM)

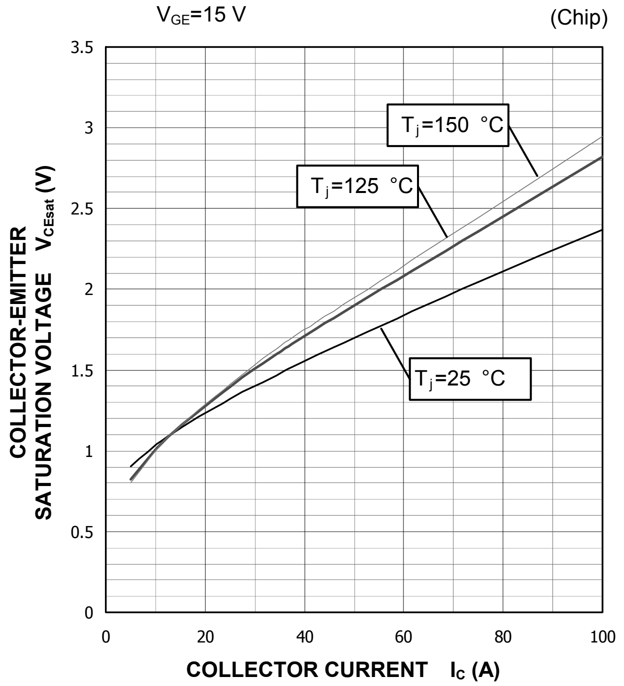
Single pulse, T_C=25 °C



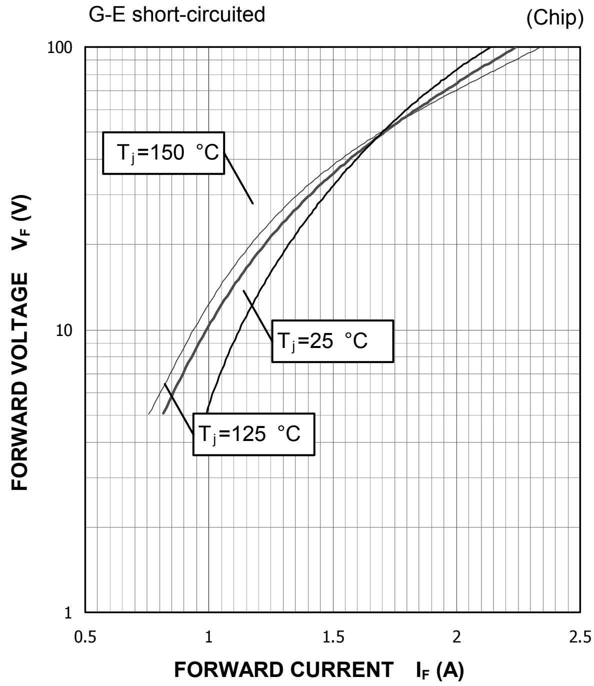
$R_{th(j-c)Q}$=0.25 K/W, $R_{th(j-c)D}$=0.40 K/W

BRAKE PART

COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)

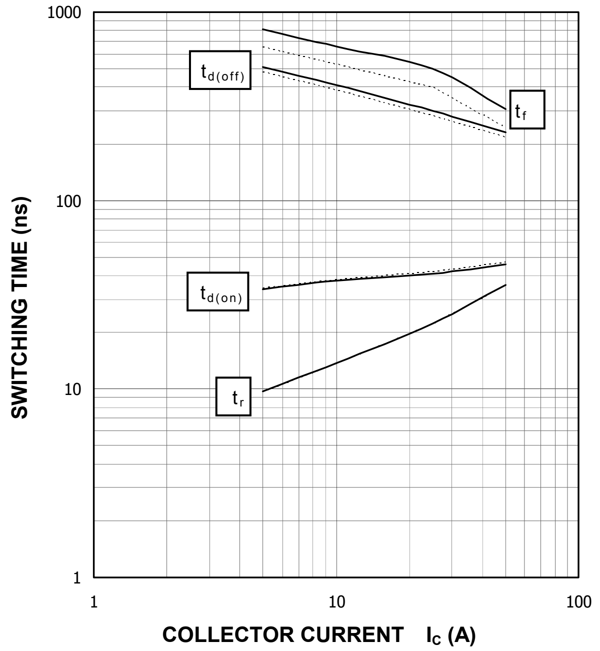


CLAMP DIODE FORWARD CHARACTERISTICS (TYPICAL)



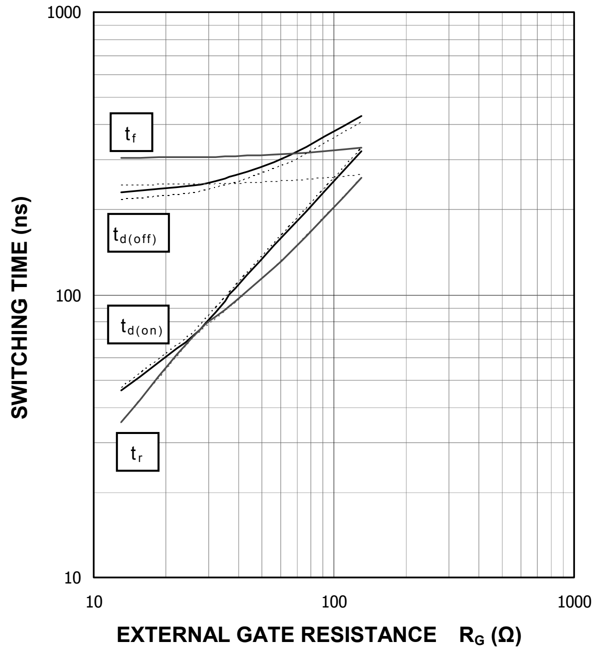
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

V_{CC}=600 V, V_{GE}=±15 V, R_G=13 Ω, INDUCTIVE LOAD
———: T_j=150 °C, - - - - -: T_j=125 °C

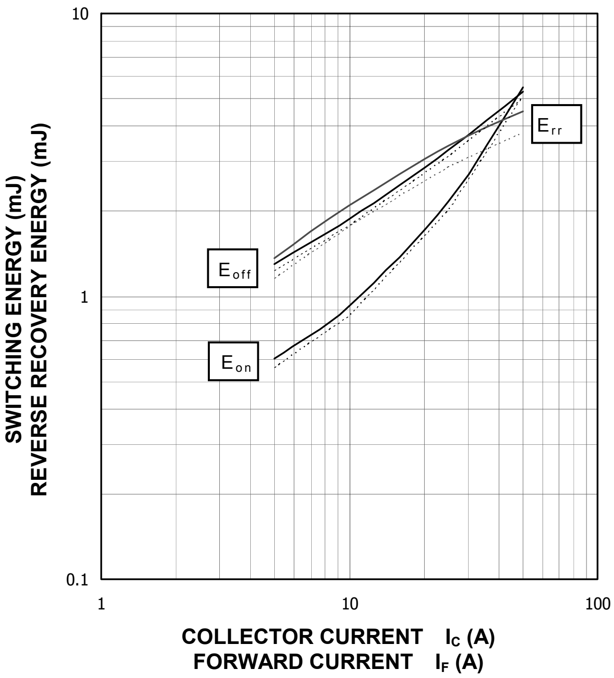


HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)

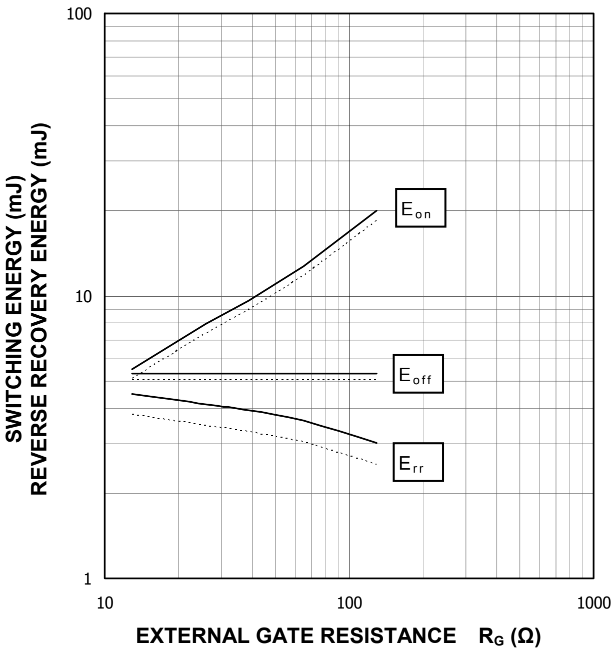
V_{CC}=600 V, I_C=50 A, V_{GE}=±15 V, INDUCTIVE LOAD
———: T_j=150 °C, - - - - -: T_j=125 °C



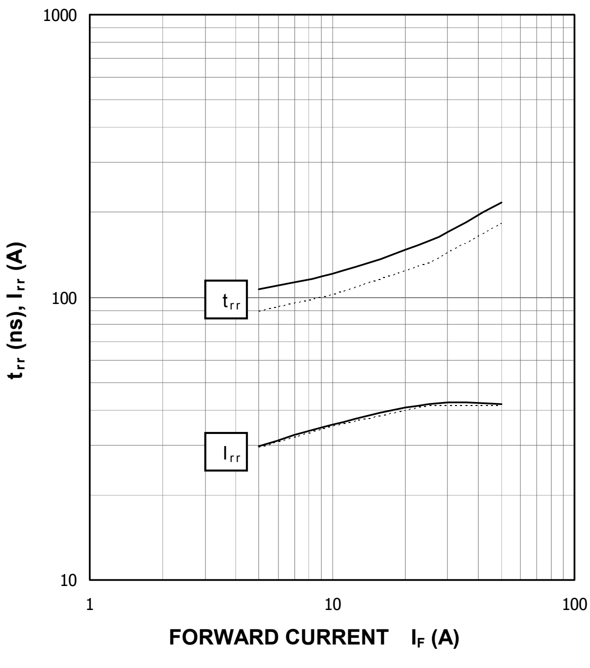
HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=13 Ω,
INDUCTIVE LOAD, PER PULSE
———: T_j=150 °C, - - - - -: T_j=125 °C



HALF-BRIDGE
SWITCHING CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, I_C/I_F=50 A, V_{GE}=±15 V,
INDUCTIVE LOAD, PER PULSE
———: T_j=150 °C, - - - - -: T_j=125 °C

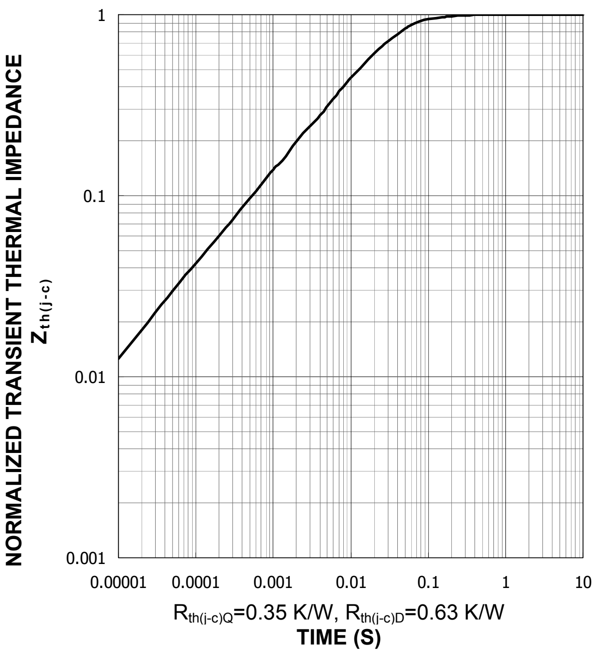


CLAMP DIODE
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)
V_{CC}=600 V, V_{GE}=±15 V, R_G=13 Ω, INDUCTIVE LOAD
———: T_j=150 °C, - - - - -: T_j=125 °C



TRANSIENT THERMAL IMPEDANCE
CHARACTERISTICS
(MAXIMUM)

Single pulse, T_C=25°C



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