

2MBI450XNA170-50

IGBT Modules

Power Module (X series)
1700V / 450A / 2-in-1 package

■ Features

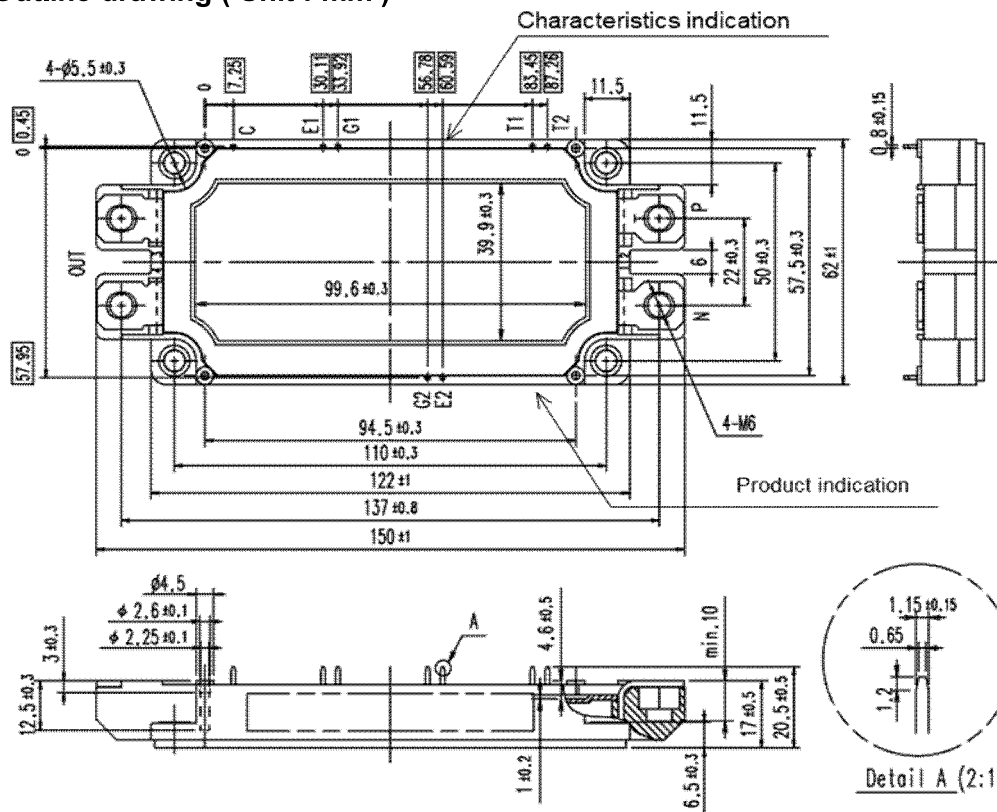
- Low $V_{CE(sat)}$
- Low Inductance Module structure
- Solder pin terminals

■ Applications

- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems



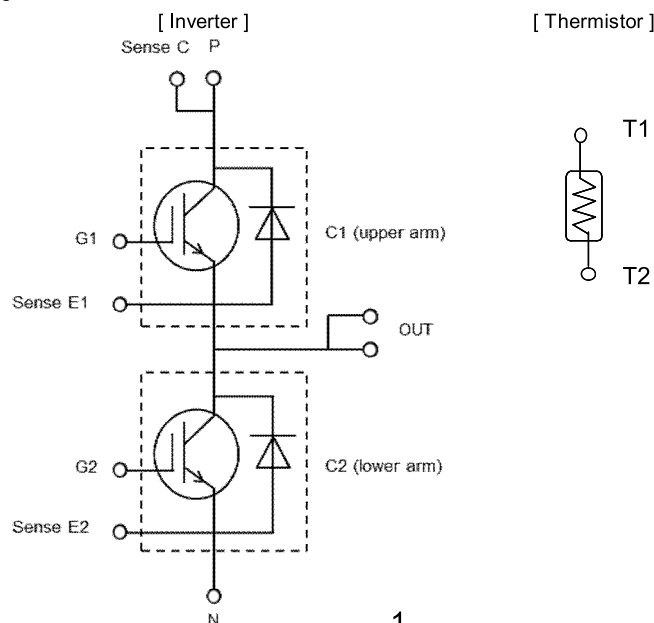
■ Outline drawing (Unit : mm)



NOTE) shows theoretical dimension and tolerance is ± 0.5

Weight: 350 g(typ.)

■ Equivalent circuit



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■ Absolute maximum ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

Items		Symbols	Conditions	Maximum ratings	Units
Collector-Emitter voltage, Gate-Emitter short-circuited		V_{CES}		1700	V
Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}		± 20	V
Collector current		I_C	Continuous	$T_c = 90^\circ\text{C}$	A
Repetitive peak collector current		I_{CRM}	1ms	900	
Forward current		I_F		450	
Repetitive peak forward current		I_{FRM}	1ms	900	
Total power dissipation		P_{tot}	1 device	2340	W
Virtual junction temperature		T_{vj}		175	$^\circ\text{C}$
Operating junction temperature (under switching conditions)		T_{vjop}		175	
Case temperature		T_c		125	
Storage temperature		T_{stg}		-40 ~ 125	
Isolation voltage	Between terminal and copper base (*1)	V_{isol}	AC: 1min.	3400	Vrms
	Between thermistor and others (*2)				
Mounting torque of screws to heatsink		M_s	M5	2.5~6.0	N·m
Mounting torque of screws to terminals		M_t	M6	3.5~6.0	

(*1) All terminals should be connected together during the test.

(*2) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

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■ Electrical characteristics (at $T_{vj} = 25^\circ\text{C}$ unless otherwise specified)

Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1700V$		-	-	150	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	300	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 450mA$		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 450A$	$T_{vj}=25^{\circ}C$	-	2.10	2.55	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.60	2.05	
			$T_{vj}=125^{\circ}C$	-	2.00	-	
			$T_{vj}=150^{\circ}C$	-	2.10	-	
			$T_{vj}=175^{\circ}C$	-	2.20	-	
Internal gate resistance	r_g	-		-	2.17	-	Ω
Capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	62	-	nF
	C_{oes}			-	1.7	-	
	C_{res}			-	0.38	-	
Gate charge	Q_G	$V_{CC} = 900V, I_C = 450A$ $V_{GE} = -15 \rightarrow +15V$		-	3.3	-	μC
Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F = 450A$	$T_{vj}=25^{\circ}C$	-	2.20	2.65	V
	V_F (chip)		$T_{vj} = 25^{\circ}C$	-	1.70	2.15	
			$T_{vj}=125^{\circ}C$	-	1.80	-	
			$T_{vj}=150^{\circ}C$	-	1.85	-	
			$T_{vj}=175^{\circ}C$	-	1.80	-	
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 900V$ $I_C, I_F = 450A$ $V_{GE} = \pm 15V$ $R_G = \pm 0.47\Omega$ $L_S = 35nH$	$T_{vj} = 25^{\circ}C$	-	0.41	-	μs
			$T_{vj}=125^{\circ}C$	-	0.44	-	
			$T_{vj}=150^{\circ}C$	-	0.44	-	
			$T_{vj}=175^{\circ}C$	-	0.47	-	
	t_r		$T_{vj} = 25^{\circ}C$	-	0.07	-	
			$T_{vj}=125^{\circ}C$	-	0.09	-	
			$T_{vj}=150^{\circ}C$	-	0.09	-	
			$T_{vj}=175^{\circ}C$	-	0.10	-	
	$t_{d(off)}$		$T_{vj} = 25^{\circ}C$	-	0.52	-	
			$T_{vj}=125^{\circ}C$	-	0.58	-	
			$T_{vj}=150^{\circ}C$	-	0.58	-	
			$T_{vj}=175^{\circ}C$	-	0.61	-	
	t_f		$T_{vj} = 25^{\circ}C$	-	0.42	-	
			$T_{vj}=125^{\circ}C$	-	0.61	-	
			$T_{vj}=150^{\circ}C$	-	0.66	-	
			$T_{vj}=175^{\circ}C$	-	0.70	-	
Reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}C$	-	0.23	-		
		$T_{vj}=125^{\circ}C$	-	0.34	-		
		$T_{vj}=150^{\circ}C$	-	0.42	-		
		$T_{vj}=175^{\circ}C$	-	0.48	-		

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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■ Electrical characteristics (at $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Items		Symbols	Conditions		Characteristics			Units
					min.	typ.	max.	
Switching loss (per pulse)		E_{on}	$V_{\text{CC}} = 900\text{V}$ $I_{\text{C}}, I_{\text{F}} = 450\text{A}$ $V_{\text{GE}} = \pm 15\text{ V}$ $R_{\text{G}} = \pm 0.47\Omega$ $L_{\text{S}} = 35\text{ nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	93	-	mJ
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	130	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	139	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	160	-	
		E_{off}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	99	-	
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	142	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	149	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	155	-	
		E_{rr}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	61	-	
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	96	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	114	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	126	-	
Thermistor	Resistance	R	$T = 25^{\circ}\text{C}$	-	5000	-	Ω	
			$T = 100^{\circ}\text{C}$	465	495	520		
	B value	B	$T = 25/ 50^{\circ}\text{C}$	3305	3375	3450	K	

NOTICE:

The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment.

We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

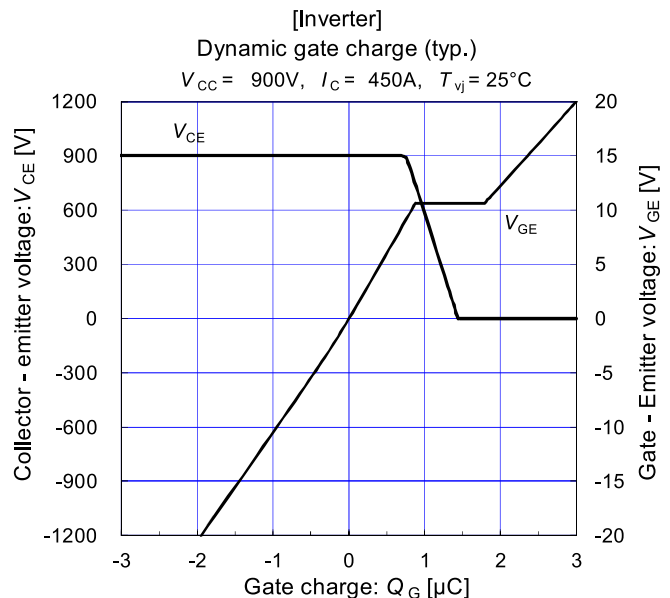
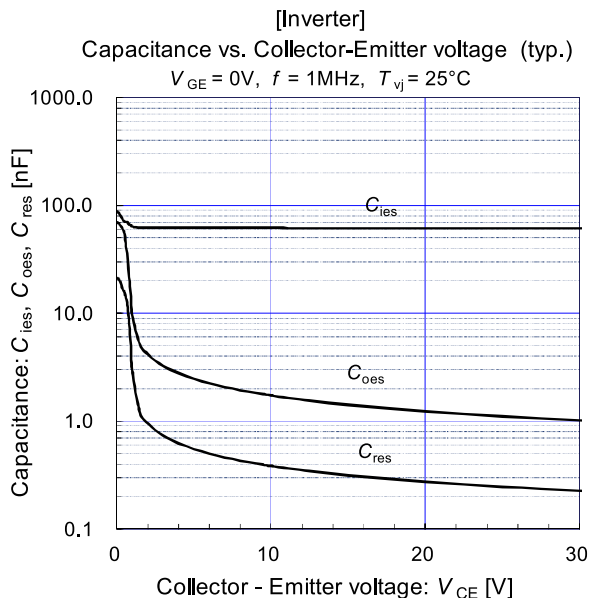
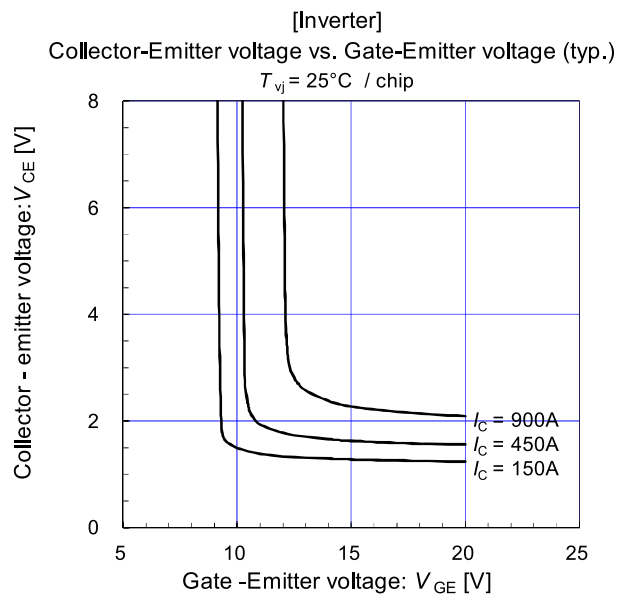
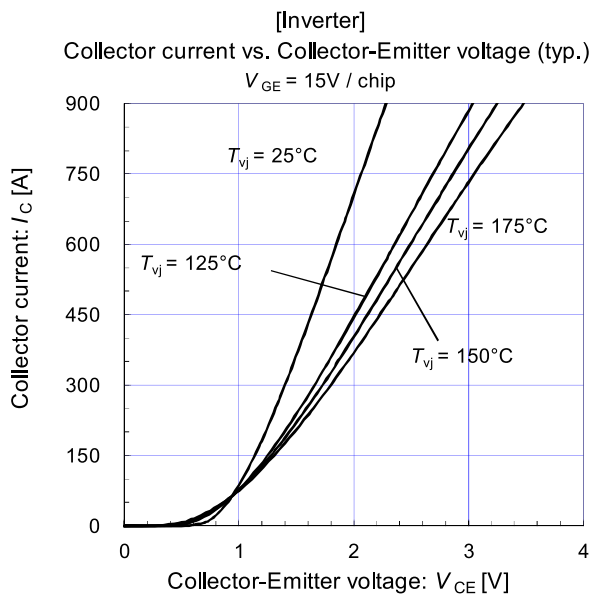
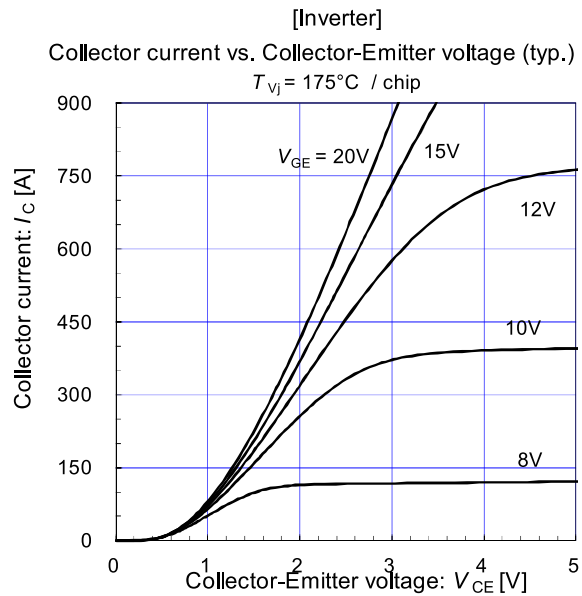
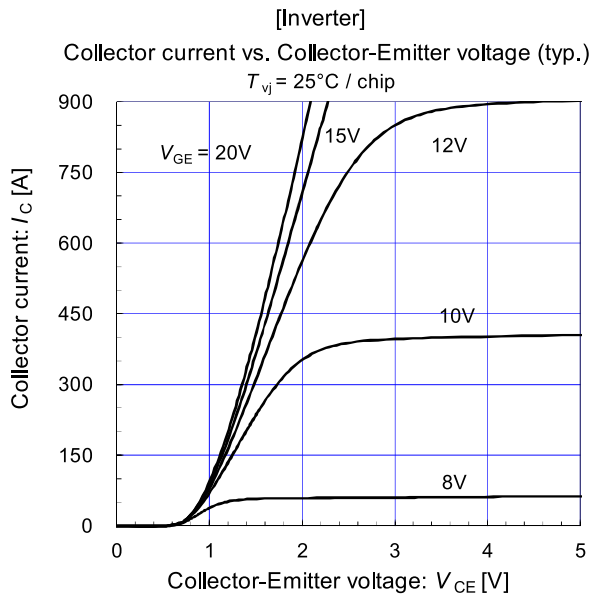
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.064	K/W
		Inverter FWD	-	-	0.100	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0167	-	

(*1) This is the value which is defined mounting on the additional heatsink with thermal grease.

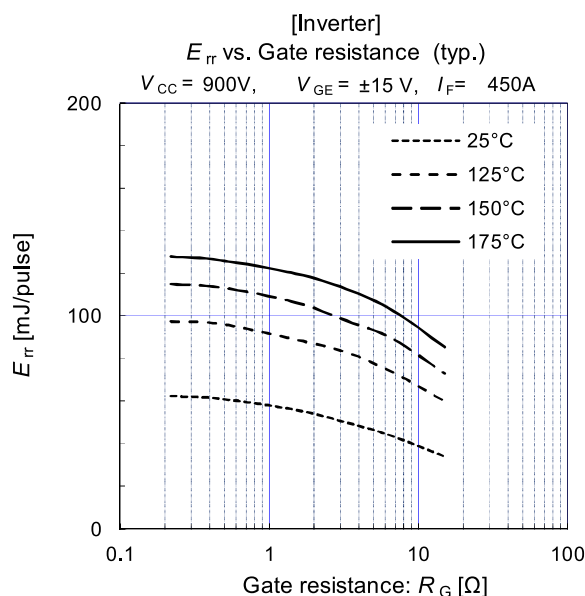
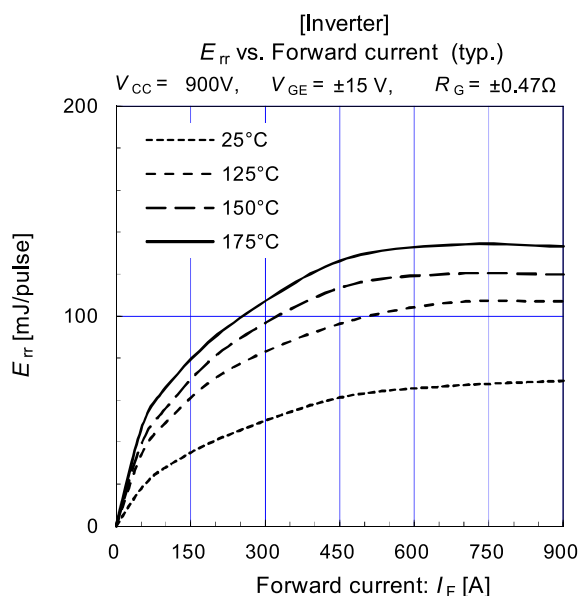
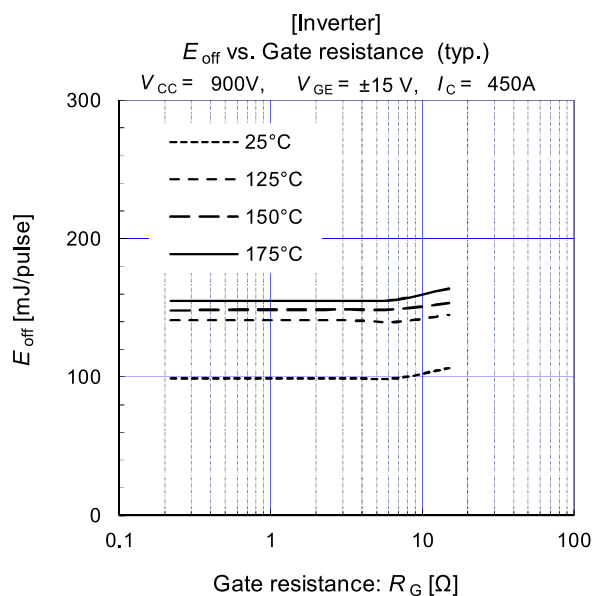
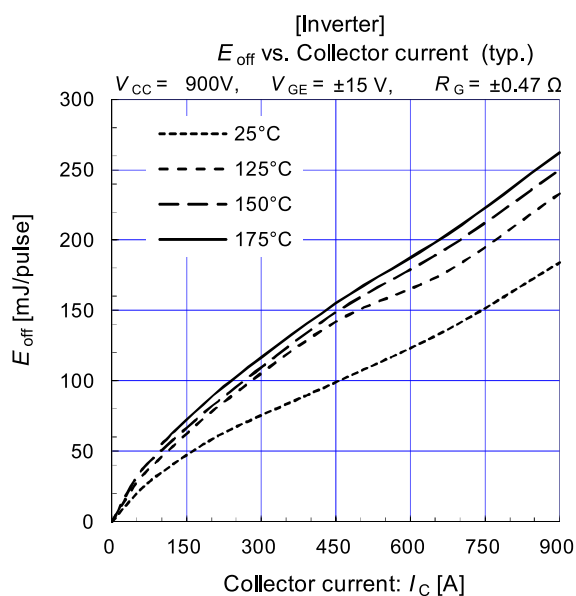
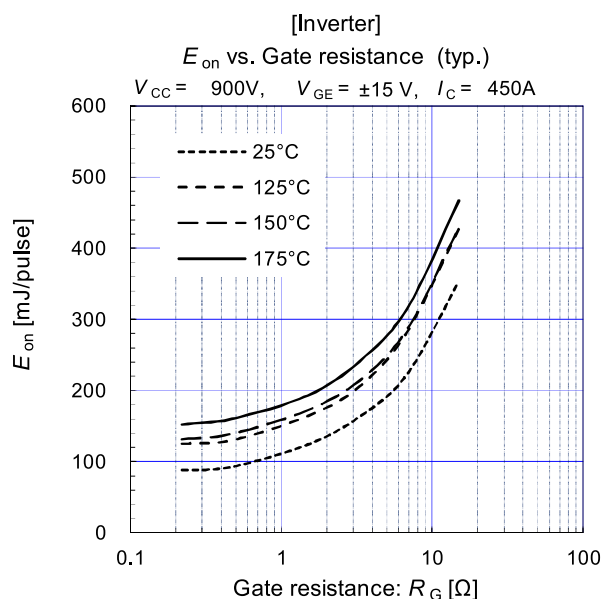
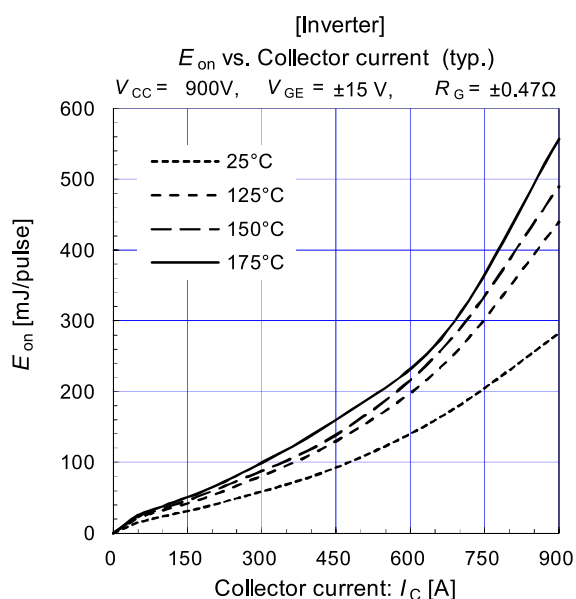
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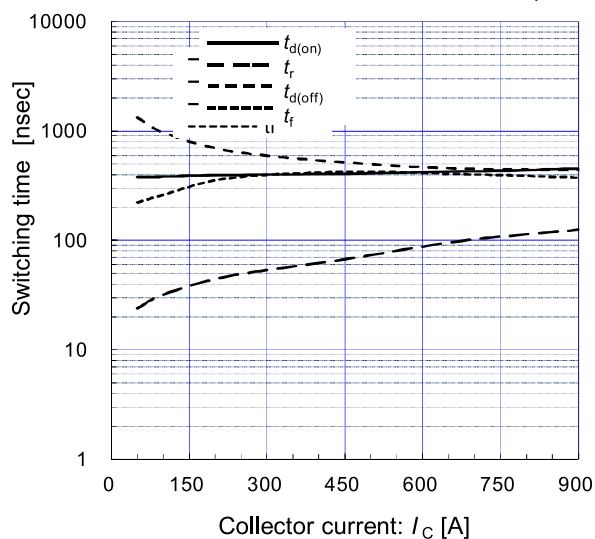
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[Inverter]

Switching time vs. Collector current (typ.)

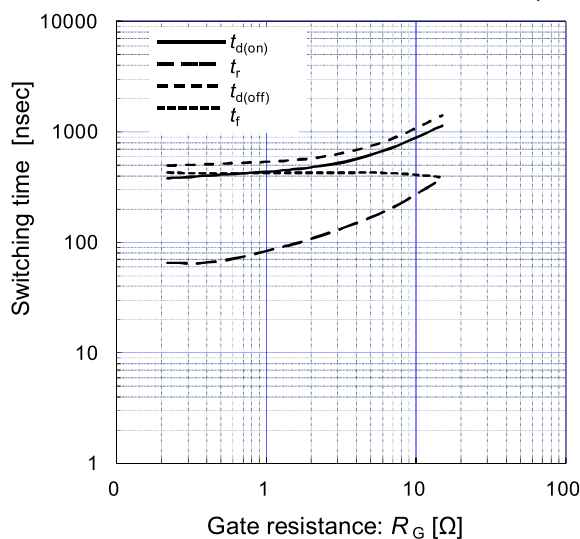
$V_{CC} = 900V$, $R_G = \pm 0.47\Omega$, $V_{GE} = \pm 15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

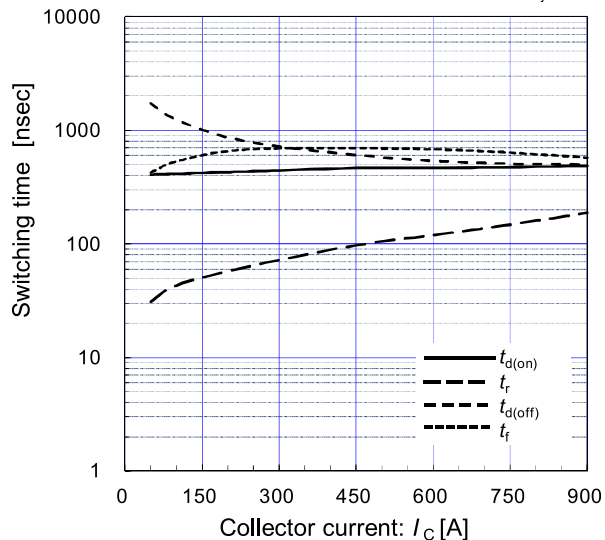
$V_{CC} = 900V$, $I_C = 450A$, $V_{GE} = \pm 15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

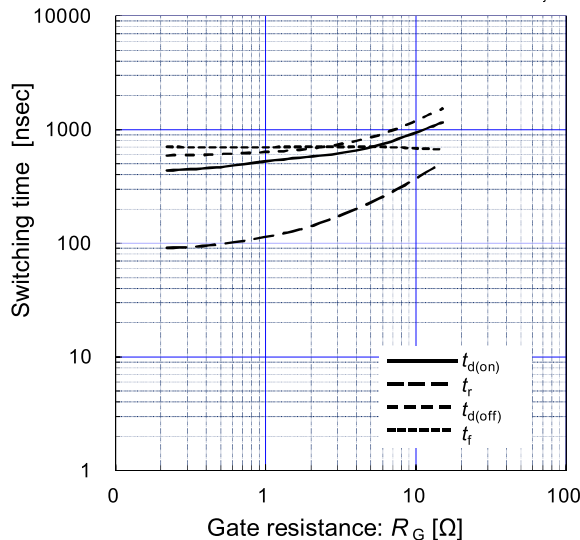
$V_{CC} = 900V$, $R_G = \pm 0.47\Omega$, $V_{GE} = \pm 15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

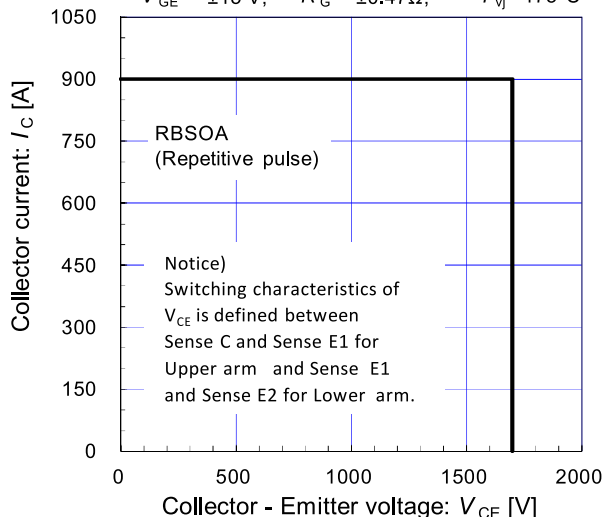
$V_{CC} = 900V$, $I_C = 450A$, $V_{GE} = \pm 15V$, $T_{vj} = 175^\circ C$



[Inverter]

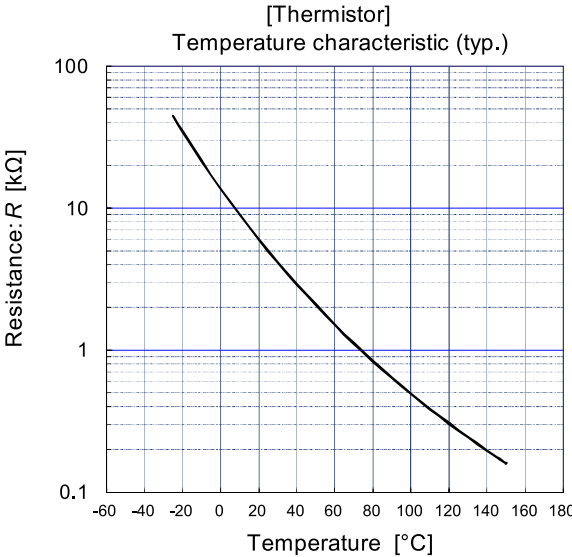
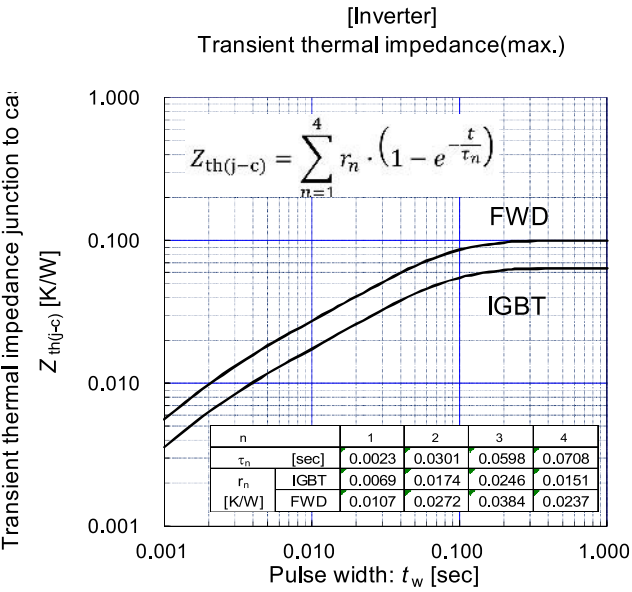
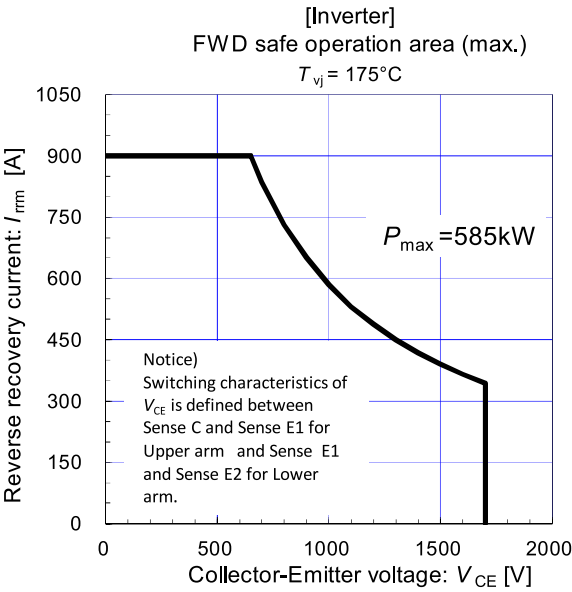
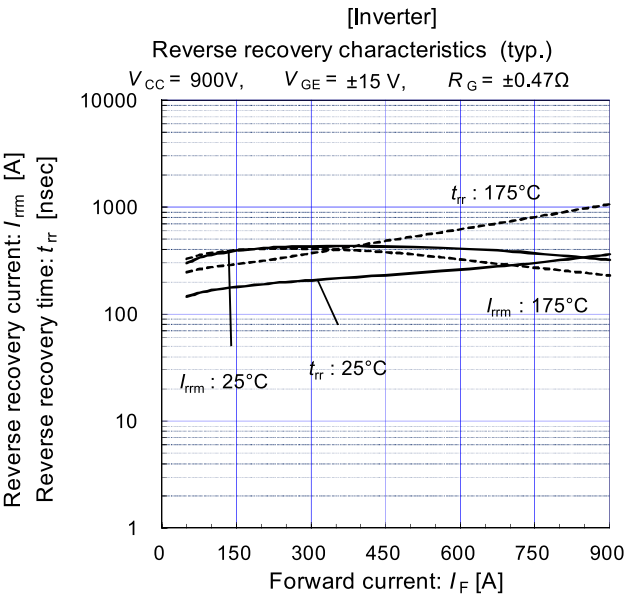
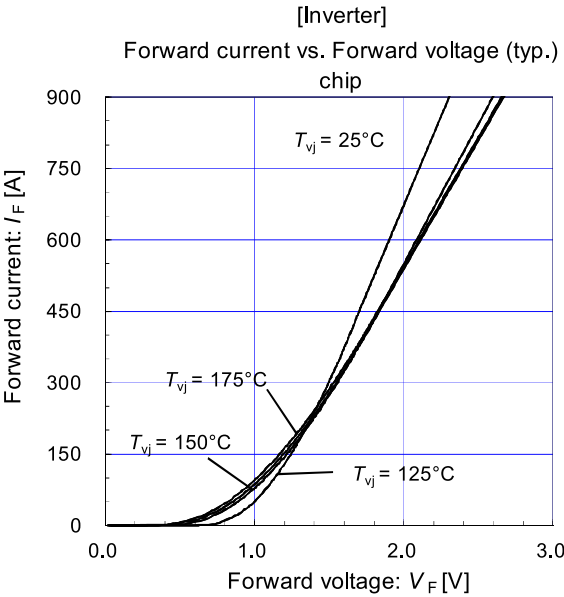
Reverse bias safe operating area (max.)

$V_{GE} = \pm 15V$, $R_G = \pm 0.47\Omega$, $T_{vj} = 175^\circ C$



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