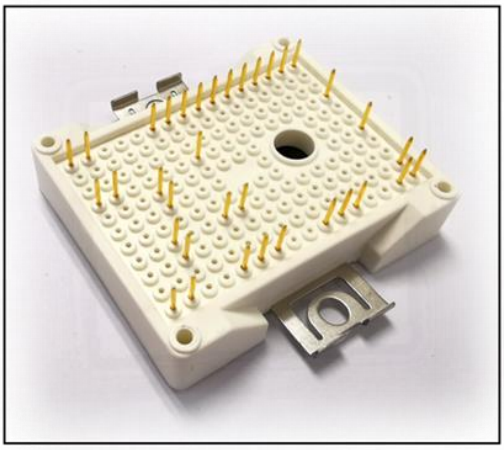
Features

- Low $V_{CE(sat)}$
- Fast Switching
- High Ruggedness
- Short-Circuit Rated

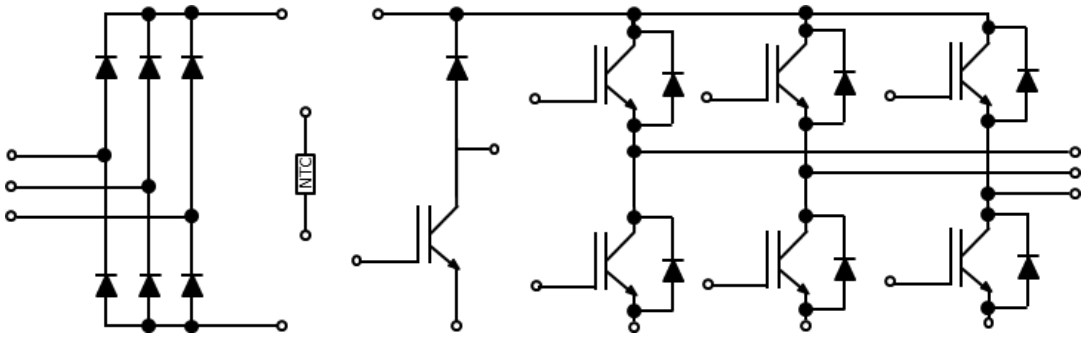
Product Summary	
V_{CES}	1200V
I_C	50A
$V_{CE(sat),typ}$	1.55V



Applications

- General Purpose Inverters
- Frequency Converters
- Industrial Motor Drives
- Servos

Internal Connection



• IGBT, Inverter

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Collector-to-Emitter Voltage	V_{CES}	1200	V
Gate-to-Emitter Voltage	V_{GES}	±20	
Transient Gate-emitter Voltage ($t_p \leq 10\mu s$, D < 0.010)		±30	
Continuous DC Collector Current (T_C = 100°C, T_J = 175°C)	I_{CDC}	50	A
Repetitive Peak Collector Current (t_p = 1ms)	I_{CRM}	100	

Electrical Characteristics (1), (2)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-to-Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0V, I_C = 250μA	1200	-	-	V
Collector-to-Emitter Leakage Current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V	-	-	1	mA
Gate-to-Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V	-	-	100	nA
Gate Threshold Voltage	$V_{GE(th)}$	V_{CE} = V_{GE} , I_C = 1.5mA	5.2	6.2	7.2	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C = 50A	-	1.55	2.0	V
		V_{GE} = 15V, I_C = 50A, T_J = 150°C	-	2.0	-	
		V_{GE} = 15V, I_C = 50A, T_J = 175°C	-	2.05	-	
Total Gate Charge	Q_g	V_{CC} = 600V, V_{GE} = ±15V,	-	354	-	nC
Input Capacitance	C_{iss}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	5120	-	pF
Output Capacitance	C_{oss}		-	138	-	
Reverse Transfer Capacitance	C_{rss}		-	56	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 5Ω, I_C = 50A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery.	-	75	-	ns
Rise Time	t_r		-	76	-	
Turn-off Delay time	$t_{d(OFF)}$		-	344	-	
Fall Time	t_f		-	162	-	
Turn-On Switching Loss	E_{on}		-	4.85	-	mJ
Turn-Off Switching Loss	E_{off}		-	3.06	-	
IGBT Total Switching Loss	E_{ts}		-	7.91	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 5Ω, I_C = 50A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery. T_J =150°C	-	78	-	ns
Rise Time	t_r		-	83	-	
Turn-off Delay time	$t_{d(OFF)}$		-	404	-	
Fall Time	t_f		-	225	-	
Turn-On Switching Loss	E_{on}		-	7.65	-	mJ
Turn-Off Switching Loss	E_{off}		-	4.55	-	
IGBT Total Switching Loss	E_{ts}		-	12.2	-	
Short Circuit Collector Current	$I_{C(SC)}$	V_{GE} = 15V, V_{CC} ≤ 600V, t_{SC} ≤ 10μs	-	230	-	A

• Diode, Inverter

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V
Continuous DC Forward Current	I_F	50	A
Repetitive Peak Forward Current (t_P = 1ms)	I_{FRM}	100	

Electrical Characteristics (1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 50A	-	2.0	2.45	V
		I_F = 50A, T_J = 150°C	-	1.7	-	
		I_F = 50A, T_J = 175°C	-	1.65	-	
Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 50A, dI_F/dt = - 465 A/µs	-	1.7	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	15	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.5	-	mJ

• IGBT, Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Collector-to-Emitter Voltage	V_{CES}	1200	V
Gate-to-Emitter Voltage	V_{GES}	±20	
Transient Gate-emitter Voltage ($t_p \leq 10\mu s$, D < 0.010)		±30	
Continuous DC Collector Current (T_C = 100°C, T_J = 175°C)	I_{CDC}	35	A
Repetitive Peak Collector Current (t_p = 1ms)	I_{CRM}	70	

Electrical Characteristics (1), (2)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-to-Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0V, I_C = 250µA	1200	-	-	V
Collector-to-Emitter Leakage Current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V	-	-	1	mA
Gate-to-Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V	-	-	100	nA

Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 1.5mA$	5.0	6.2	7.2	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V$, $I_C = 35A$	-	1.55	2.0	
		$V_{GE} = 15V$, $I_C = 35A$, $T_J = 150°C$	-	2.0	-	
		$V_{GE} = 15V$, $I_C = 35A$, $T_J = 175°C$	-	2.1	-	
Total Gate Charge	Q_g	$V_{CC} = 600V$, $V_{GE} = \pm 15V$	-	281	-	nC
Input Capacitance	C_{iss}	$V_{CE} = 25V$, $V_{GE} = 0V$, $f = 1MHz$	-	4098	-	pF
Output Capacitance	C_{oss}		-	103	-	
Reverse Transfer Capacitance	C_{rss}		-	43	-	
Turn-on Delay time	$t_{d(ON)}$	$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $R_G = 5\Omega$, $I_C = 35A$, $L_{load} = 0.82mH$, Energy losses include "tail" and diode reverse recovery.	-	31	-	ns
Rise Time	t_r		-	45	-	
Turn-off Delay time	$t_{d(OFF)}$		-	285	-	
Fall Time	t_f		-	172	-	
Turn-On Switching Loss	E_{on}		-	2.58	-	mJ
Turn-Off Switching Loss	E_{off}		-	2.25	-	
IGBT Total Switching Loss	E_{ts}		-	4.83	-	
Short Circuit Collector Current	$I_{C(SC)}$	$V_{GE} = 15V$, $V_{CC} \leq 600V$, $t_{SC} \leq 10\mu s$	-	197	-	A

• Diode, Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V
Continuous DC Forward Current	I_F	25	A
Repetitive Peak Forward Current ($t_P = 1ms$)	I_{FRM}	50	

Electrical Characteristics (1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	$I_F = 25A$	-	2.25	2.7	V
		$I_F = 25A$, $T_J = 150°C$	-	1.9	-	
		$I_F = 25A$, $T_J = 175°C$	-	1.8	-	

Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 25A, dI_F/dt = - 455 A/µs	-	1.5	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	15.0	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.55	-	mJ

• Diode, Rectifier

Absolute Maximum Ratings (1)

Parameter	Symbol		Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}		1600	V
Average Output Current 50/60Hz,sine wave	$I_{F(AV)}$		50	A
Surge Forward Current (V_R=0, t_P=10ms)	I_{FSM}	T_J = 25°C	520	
		T_J = 150°C	440	
I^2t – value (V_R=0, t_P = 10 ms)	I^2t	T_J = 25°C	1350	A^2s
		T_J = 150°C	968	

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 50A	-	1.17	-	V
Diode Reverse Current	I_R	V_R = 1600V T_J = 150°C	-	-	1	mA

• NTC thermistors

Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	R_{25}	-	-	5.0	-	kΩ
Deviation of R100	ΔR/R	T_C =100°C R_{100} = 493.3Ω	-5	-	5	%
Power Dissipation	P_{25}	-	-	20.0	-	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\ K))]$	-	3375	-	K

• Module

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Maximum Junction Temperature	T_j	-40 to +175	°C
Operating Junction Temperature	$T_{vj\ op}$	-40 to +150	
Storage Temperature	T_{stg}	-40 to +125	
Isolation Voltage (f = 50Hz, t = 1min.)	V_{ISO}	2.5	kV

Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Stray Inductance-module	L_{SCE}	-	30	-	nH
Module Lead Resistance, Terminal to Chip	$R_{CC'+EE'}$	-	5.0	-	mΩ
Module Lead Resistance, Terminal to Chip	$R_{AA'+CC'}$	-	6.0	-	
Junction-to-Case Thermal Resistance, per IGBT, Inverter	$R_{\theta JC}$	-	0.48	-	°C/W
Junction-to-Case Thermal Resistance, per Diode, Inverter		-	0.75	-	
Junction-to-Case Thermal Resistance, per IGBT, Brake-Chopper		-	0.54	-	
Junction-to-Case Thermal Resistance, per Diode, Brake-Chopper		-	1.30	-	
Junction-to-Case Thermal Resistance, per Diode, Rectifier		-	0.56	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Inverter	$R_{\theta CH}$	-	0.47	-	°C/W
Case-to-Heatsink Thermal Resistance, per Diode, Inverter		-	0.71	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Brake-Chopper		-	0.52	-	
Case-to-Heatsink Thermal Resistance, per Diode, Brake-Chopper		-	1.05	-	
Case-to-Heatsink Thermal Resistance, per Diode, Rectifier		-	0.53	-	
Mounting Force per Clamp	F	30	-	80	N
Weight per Module	G	-	45	-	g

(1) T_J = 25°C unless otherwise specified

(2) t_r: from 10% of Ic to 90% of Ic; t_f: from 90% of Ic to 10% of Ic;

E_{on}: from 10% of V_{GE} to 10% of V_{CE}; E_{off}: from 90% of V_{GE} to 10% of Ic.

• Typical Electrical Characteristics

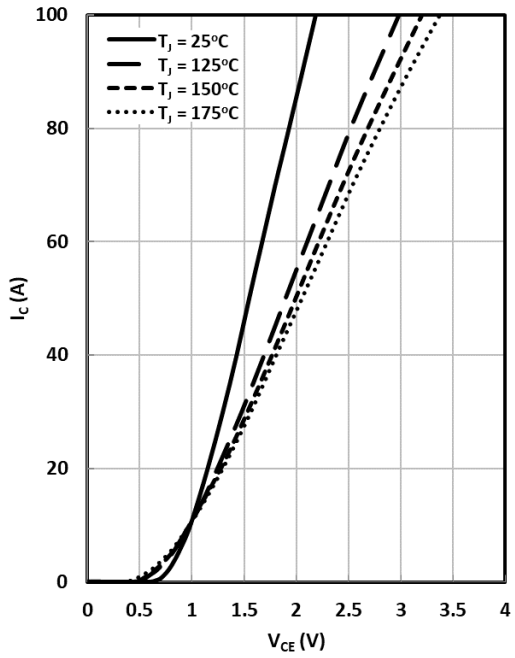


Fig. 1 IGBT (Inverter) Output Characteristics

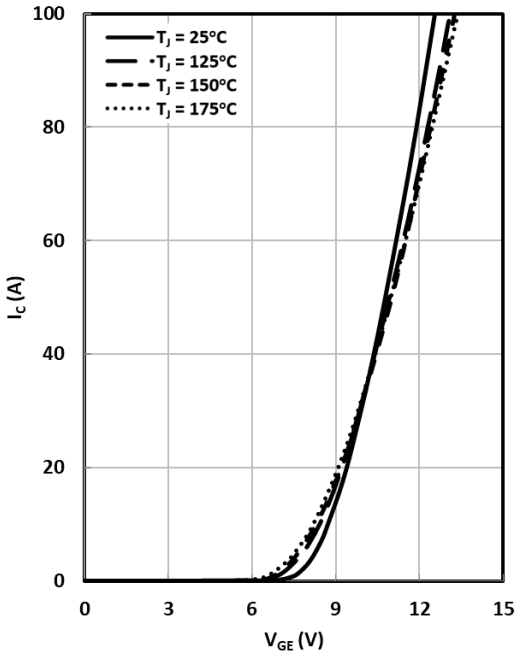


Fig. 2 IGBT (Inverter) Transfer Characteristics

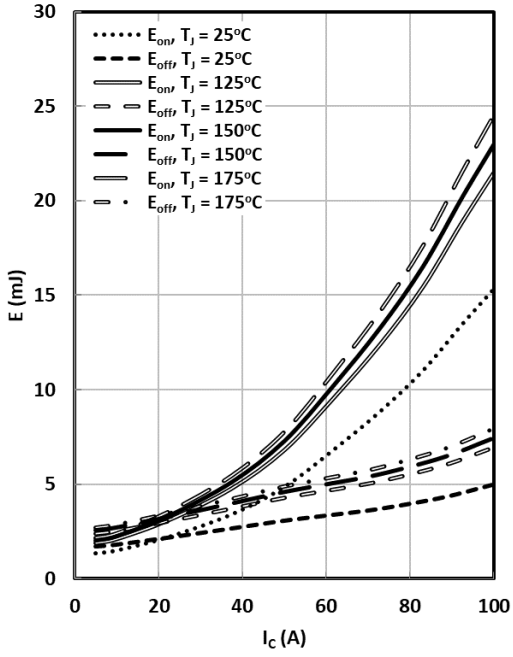


Fig. 3 IGBT (Inverter) Switching Loss vs. I_C

(V_{CC} = 600V, V_{GE} = ±15V, R_G = 5Ω)

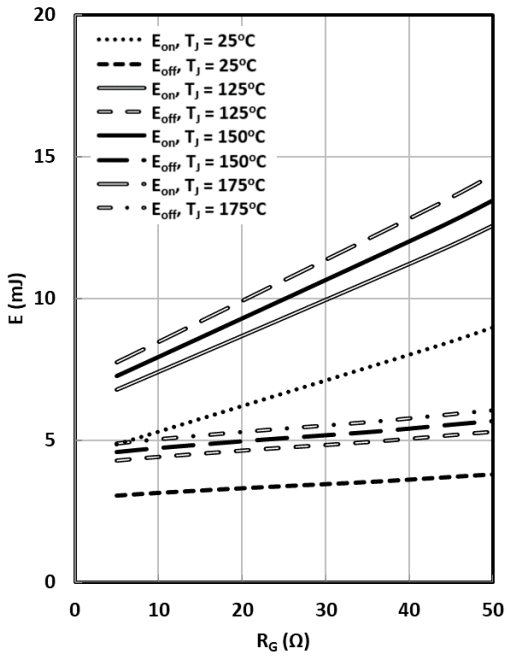


Fig. 4 IGBT (Inverter) Switching Loss vs. R_G

(V_{CC} = 600V, V_{GE} = ±15V, I_C = 50A)

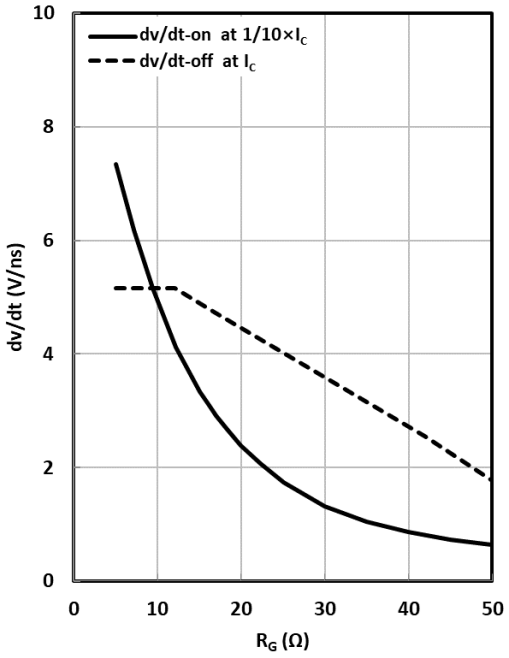


Fig. 5 IGBT (Inverter) dv/dt

(V_{CC} = 600V, V_{GE} = ±15V, I_C = 50A)

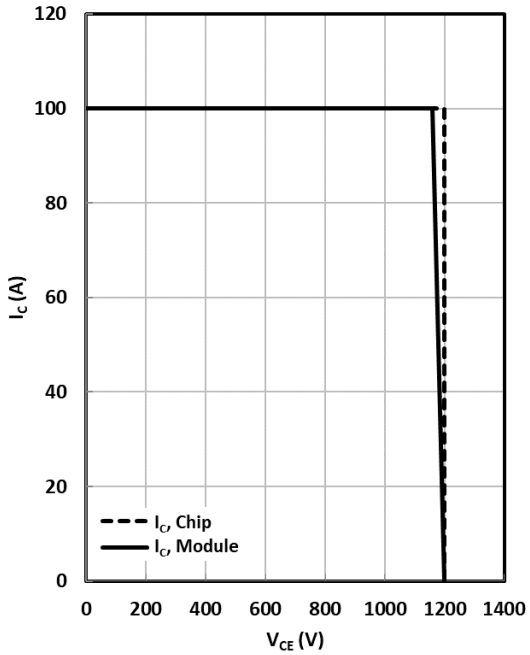


Fig. 6 RBSOA

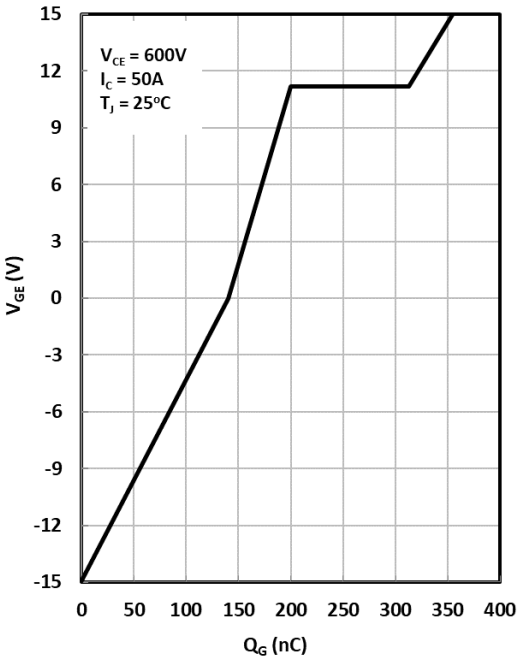


Fig. 7 IGBT (Inverter) Gate Charge Characteristics

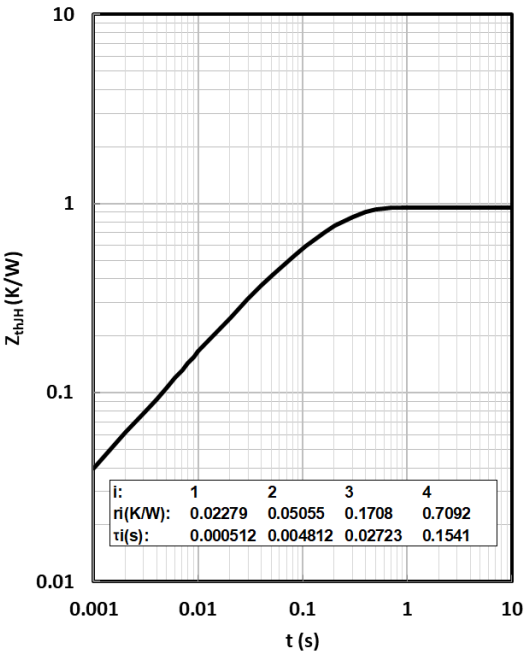


Fig. 8 IGBT (Inverter) Transient Thermal Impedance

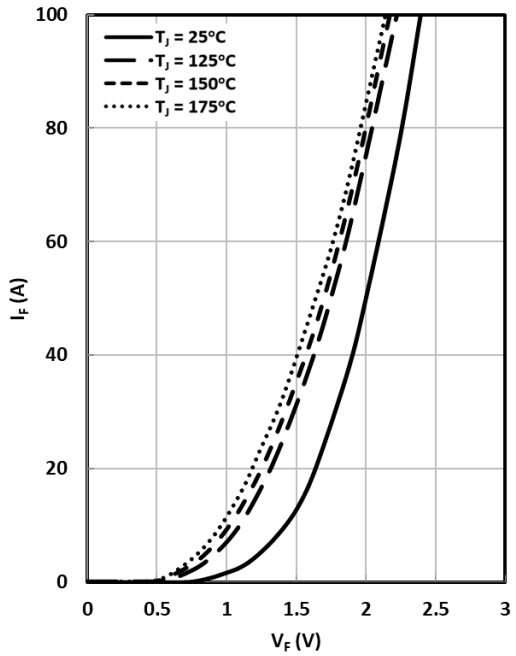


Fig. 9 Diode (Inverter) Forward Characteristics

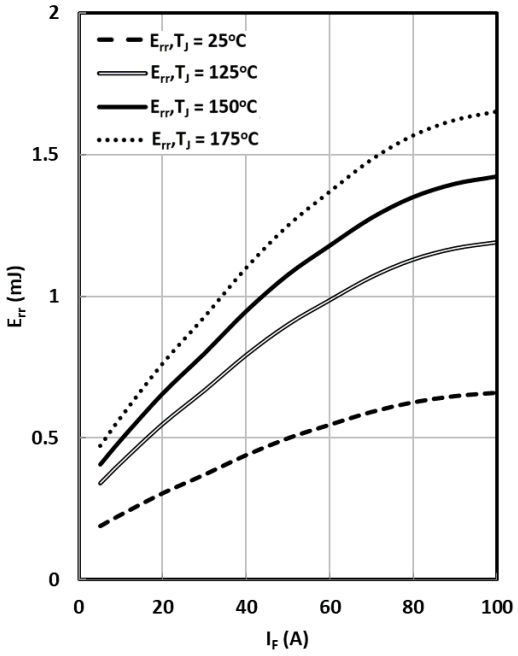


Fig. 10 Diode (Inverter) Switching Loss vs. I_F

(V_{CC} = 600V, R_G = 5Ω)

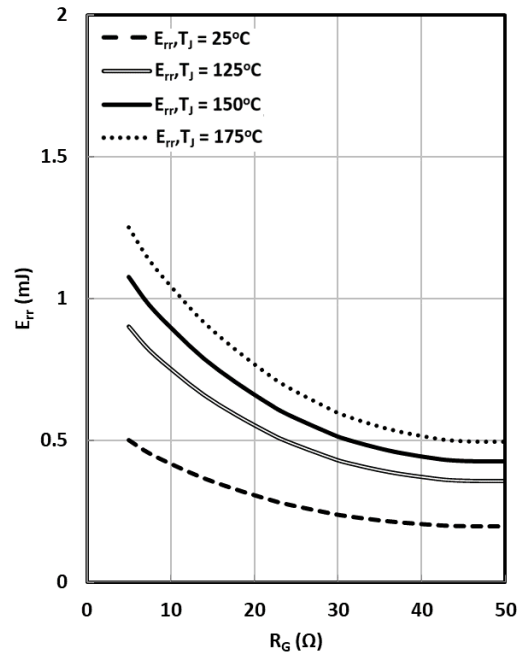


Fig. 11 Diode (Inverter) Switching Loss vs. R_G

(V_{CC} = 600V, I_F = 50A)

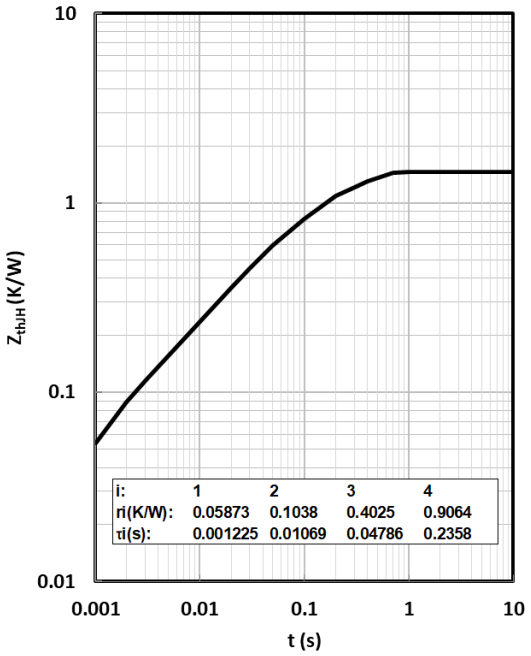


Fig. 12 Diode(Inverter) Transient Thermal Impedance

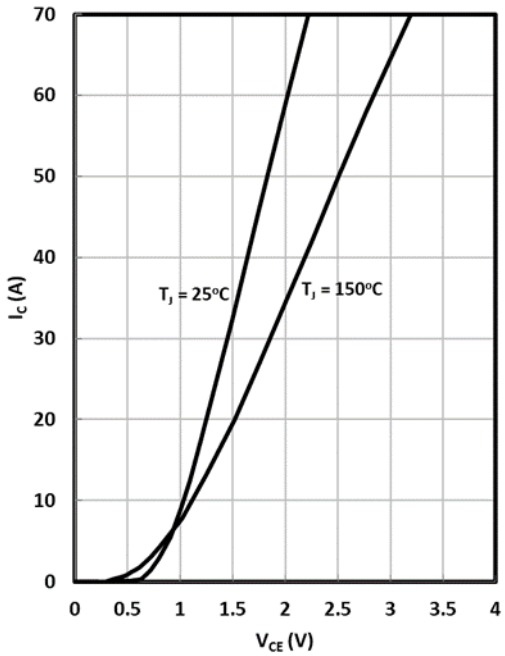


Fig. 13 IGBT (Brake-Chopper) Output Characteristics

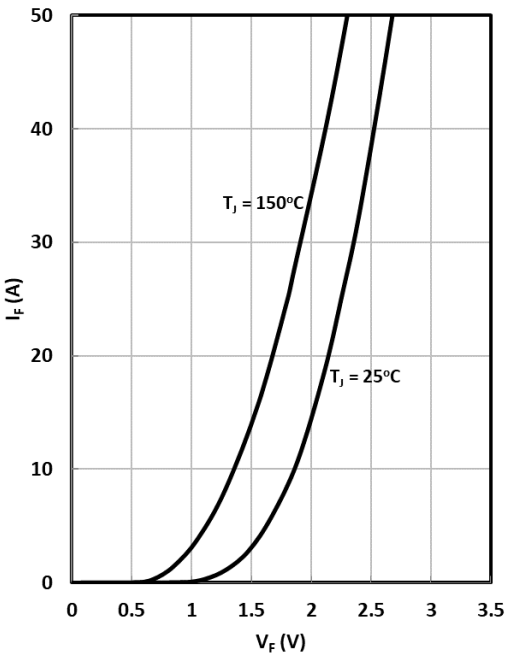


Fig. 14 Diode (Brake-Chopper) Output Characteristics

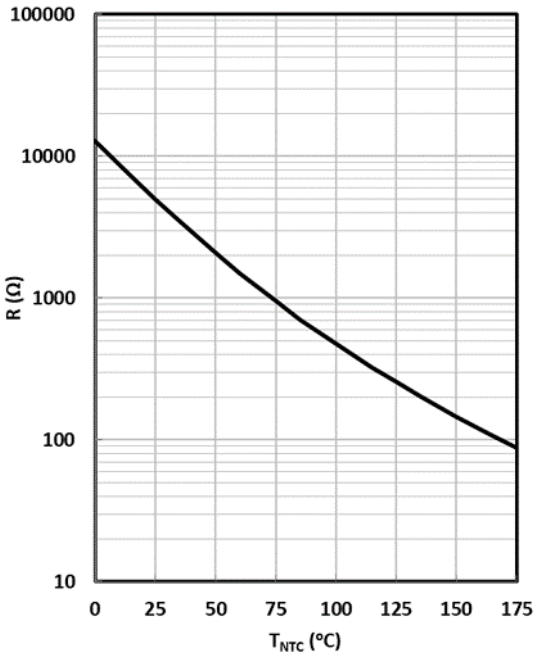
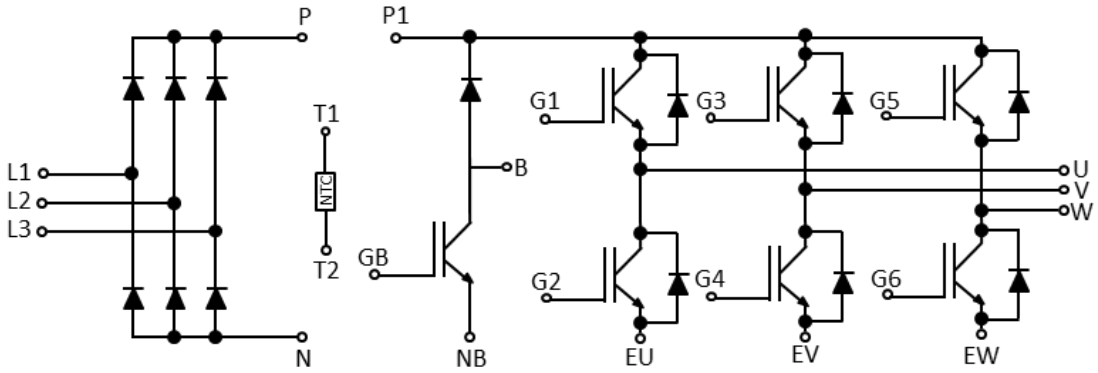
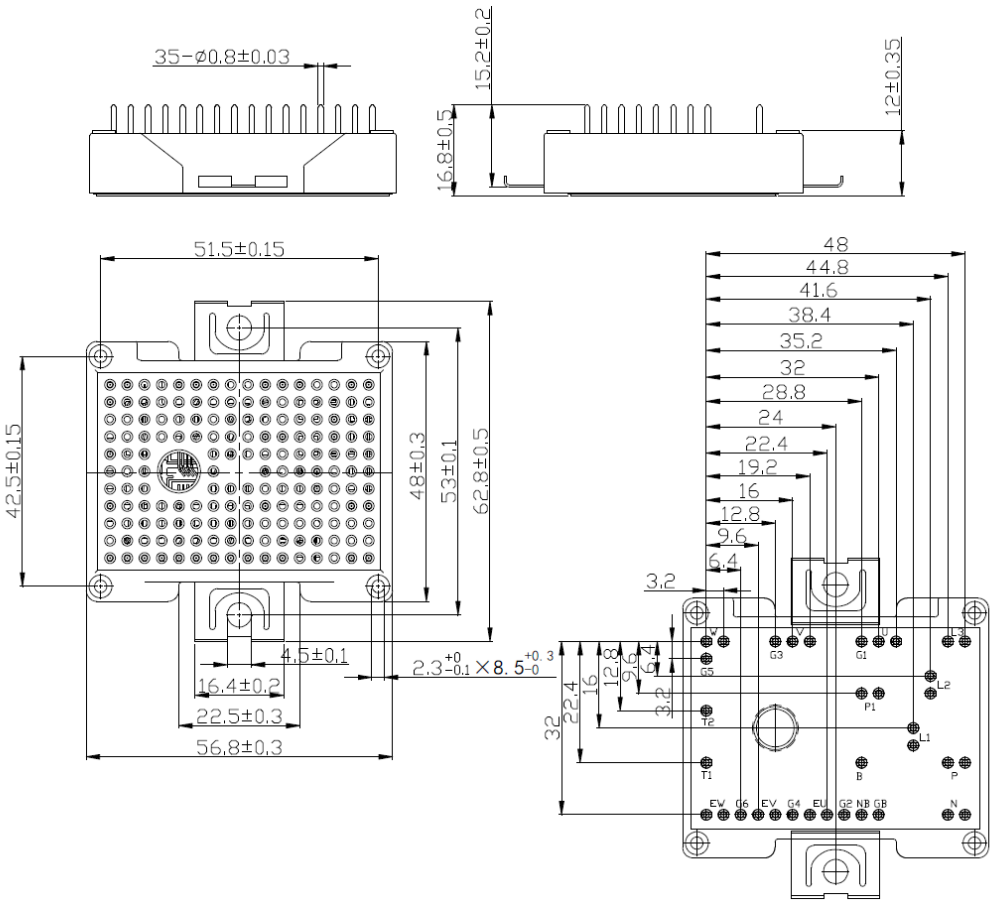


Fig. 15 NTC Temperature Characteristics

- **Circuit diagram**



- **Package Dimensions**



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