JG1D35P120FA2

Product Preview

1200V/35A PIM WITH

FIELD-STOP TRENCH IGBT, DIODE AND NTC

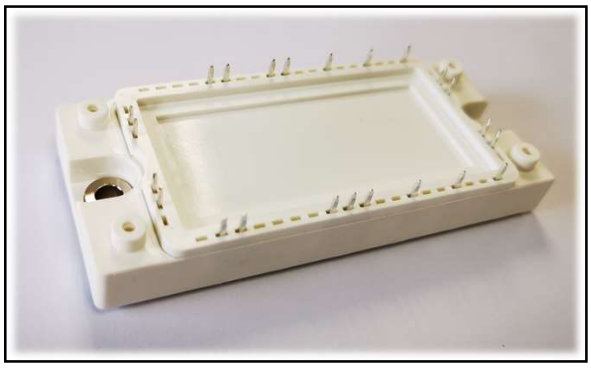
Features

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

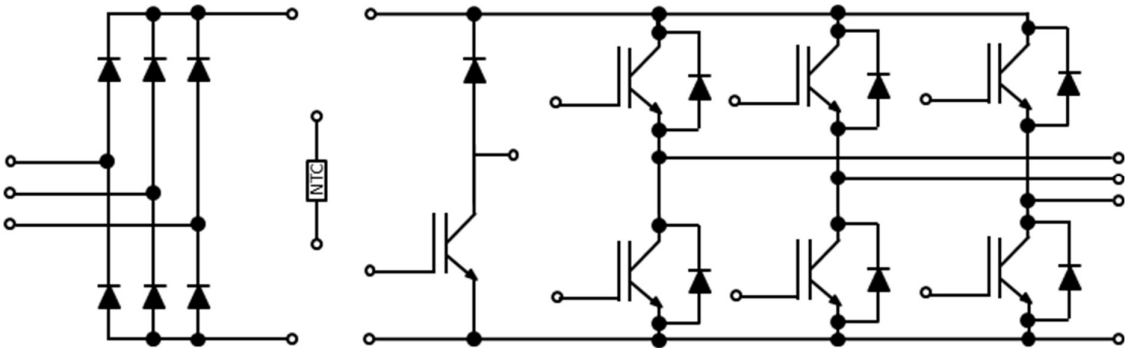
Product Summary	
V_{CES}	1200V
I_C	35A
$V_{CE(sat),typ}$	1.65V (T_J = 25°C)

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	
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	5.5	6.5	7.5	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C = 35A	-	1.65	2.0	V
		V_{GE} = 15V, I_C = 35A, T_J =125°C	-	2.0	-	
		V_{GE} = 15V, I_C = 35A, T_J =150°C	-	2.1	-	
Total Gate Charge	Q_g	V_{CC} = 600V, V_{GE} = 15V, I_C = 35A	-	148	-	nC
Input Capacitance	C_{iss}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	3460	-	pF
Output Capacitance	C_{oss}		-	154	-	
Reverse Transfer Capacitance	C_{rss}		-	41	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = 0/15V, R_G = 10Ω, I_C = 35A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery.	-	55	-	ns
Rise Time	t_r		-	58	-	
Turn-off Delay time	$t_{d(OFF)}$		-	300	-	
Fall Time	t_f		-	110	-	
Turn-On Switching Loss	E_{on}		-	2.8	-	mJ
Turn-Off Switching Loss	E_{off}		-	1.6	-	
IGBT Total Switching Loss	E_{ts}		-	4.4	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = 0/15V, R_G = 10Ω, I_C = 35A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery. T_J =150°C	-	57	-	ns
Rise Time	t_r		-	60	-	
Turn-off Delay time	$t_{d(OFF)}$		-	320	-	
Fall Time	t_f		-	136	-	
Turn-On Switching Loss	E_{on}		-	4.95	-	mJ
Turn-Off Switching Loss	E_{off}		-	2.15	-	
IGBT Total Switching Loss	E_{ts}		-	7.1	-	
Short Circuit Collector Current	$I_{C(SC)}$	V_{GE} = 15V, V_{CC} ≤ 600V, t_{SC} ≤ 10μs	-	160	-	A

• Diode, Inverter

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V
Continuous DC Forward Current (T_c = 100 °C, T_J = 150°C)	I_F	35	A
Repetitive Peak Forward Current (t_P=1ms)	I_{FRM}	70	

Electrical Characteristics (1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 35A	-	2.05	2.45	V
		I_F = 35A T_J = 125°C	-	2.3	-	
		I_F = 35A T_J = 150°C	-	2.2	-	
Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 35A, dI_F/dt = -500 A/µs	-	2.15	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	18	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.75	-	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	
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	5.5	6.5	7.5	V

Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C = 35A	-	1.65	2.0	
		V_{GE} = 15V, I_C = 35A, T_J =125°C	-	2.0	-	
		V_{GE} = 15V, I_C = 35A, T_J =150°C	-	2.1	-	
Total Gate Charge	Q_g	V_{CC} = 600V, V_{GE} = 15V, I_C = 35A	-	148	-	nC
Input Capacitance	C_{iss}	V_{CE} = 25V,	-	3460	-	pF
Output Capacitance	C_{oss}	V_{GE} = 0V,	-	154	-	
Reverse Transfer Capacitance	C_{rss}	f = 1MHz	-	41	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = 0/15V, R_G = 10Ω, I_C = 35A, L_{load} = 0.82mH, Energy losses include "tail" and diode reverse recovery.	-	55	-	ns
Rise Time	t_r		-	58	-	
Turn-off Delay time	$t_{d(OFF)}$		-	300	-	
Fall Time	t_f		-	110	-	
Turn-On Switching Loss	E_{on}		-	2.8	-	mJ
Turn-Off Switching Loss	E_{off}		-	1.6	-	
IGBT Total Switching Loss	E_{ts}		-	4.4	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = 0/15V, R_G = 10Ω, I_C = 35A, L_{load} = 0.82mH, Energy losses include "tail" and diode reverse recovery. T_J =150°C	-	57	-	ns
Rise Time	t_r		-	60	-	
Turn-off Delay time	$t_{d(OFF)}$		-	320	-	
Fall Time	t_f		-	136	-	
Turn-On Switching Loss	E_{on}		-	4.95	-	mJ
Turn-Off Switching Loss	E_{off}		-	2.15	-	
IGBT Total Switching Loss	E_{ts}		-	7.1	-	

• Diode, Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V
Continuous DC Forward Current (T_c = 100 °C, T_J = 150°C)	I_F	15	A
Repetitive Peak Forward Current (t_P=1ms)	I_{FRM}	30	

Electrical Characteristics (1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 15A	-	2.25	2.7	V
		I_F = 15A T_J = 125°C	-	2.5	-	
		I_F = 15A T_J = 150°C	-	2.4	-	
Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 15A, dI_F/dt = -600 A/µs	-	1.2	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	14.5	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.4	-	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 (T_c = 100 °C)	$I_{F(AV)}$	35	A
Maximum RMS Current at Rectifier Output (T_c = 100 °C)	I_{RMSM}	70	
Surge Forward Current (V_R=0, t_P=10ms)	I_{FSM}	400	

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 35A T_J =150°C	-	1.1	-	V
Diode Reverse Current	I_R	V_R = 1600V T_J = 150°C	-	-	2.0	mA

• NTC thermistors

Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	R_{25}	-	4.75	5.0	5.25	kΩ
Deviation of R100	ΔR/R	T_C =100°C R_{100} = 493Ω	-9.22	-	9.89	%
Power Dissipation	P_{25}	-	-	1.4	-	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$	3307	3375	3442	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 +150	
Isolation Voltage (f = 50 Hz, t = 1 min.)	V_{ISO}	2.5	kV

Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Stray Inductance-module	L_{SCE}	-	35	-	nH
Module Lead Resistance, Terminal to Chip	$R_{CC'+EE'}$	-	4.0	-	mΩ
Module Lead Resistance, Terminal to Chip	$R_{AA'+CC'}$	-	3.0	-	
Junction-to-Case Thermal Resistance, per IGBT, Inverter	$R_{\theta JC}$	-	0.60	-	°C/W
Junction-to-Case Thermal Resistance, per Diode, Inverter		-	0.80	-	
Junction-to-Case Thermal Resistance, per IGBT, Brake-Chopper		-	0.60	-	
Junction-to-Case Thermal Resistance, per Diode, Brake-Chopper		-	1.30	-	
Junction-to-Case Thermal Resistance, per Diode, Rectifier		-	0.90	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Inverter	$R_{\theta CH}$	-	0.34	-	°C/W
Case-to-Heatsink Thermal Resistance, per Diode, Inverter		-	0.46	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Brake-Chopper		-	0.44	-	
Case-to-Heatsink Thermal Resistance, per Diode, Brake-Chopper		-	0.7	-	
Case-to-Heatsink Thermal Resistance, per Diode, Rectifier		-	0.40	-	
Case-to-Heatsink Thermal Resistance, per Module			0.02		
Module-to-Sink Torque	M_S	3.0	-	6.0	Nm
Weight per Module	G	-	180	-	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**

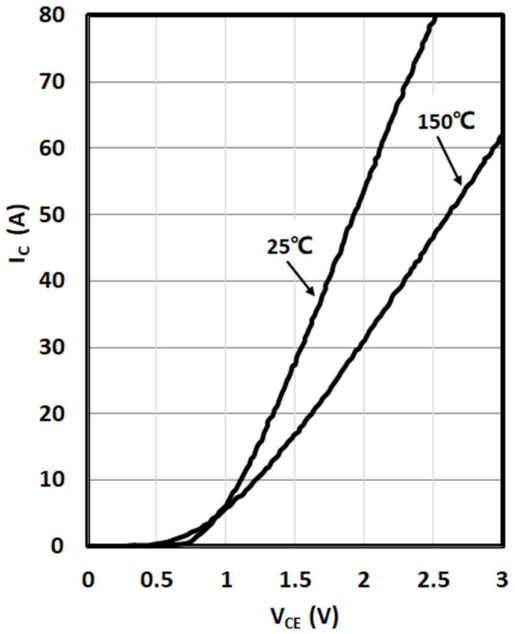


Fig. 1 IGBT (Inverter) Output Characteristics

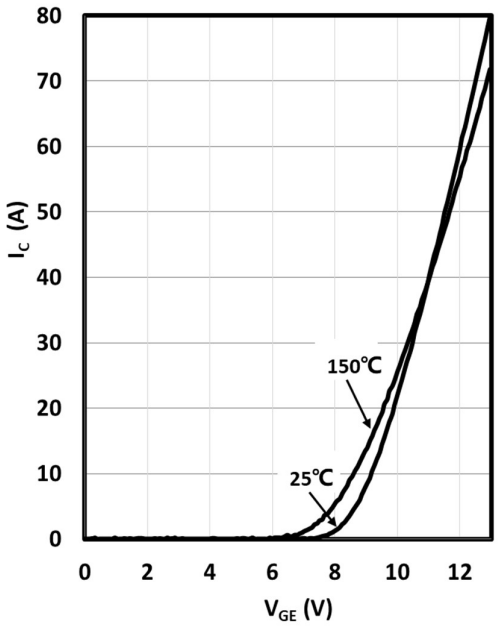


Fig. 2 IGBT (Inverter) Transfer Characteristics

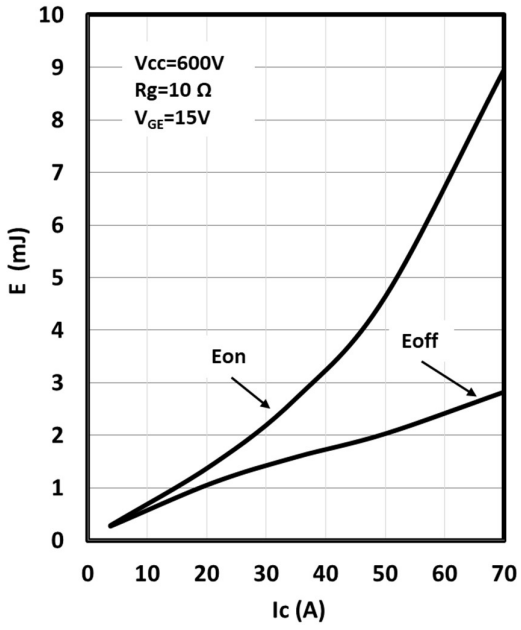


Fig. 3 IGBT (Inverter) Switching Loss vs. Ic

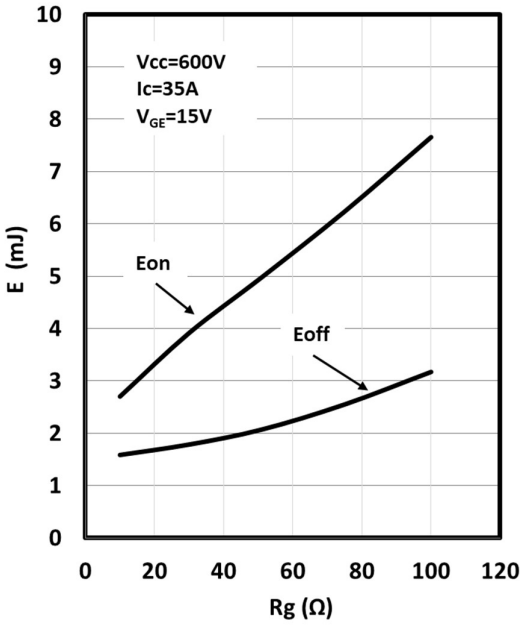


Fig. 4 IGBT (Inverter) Switching Loss vs. Rg

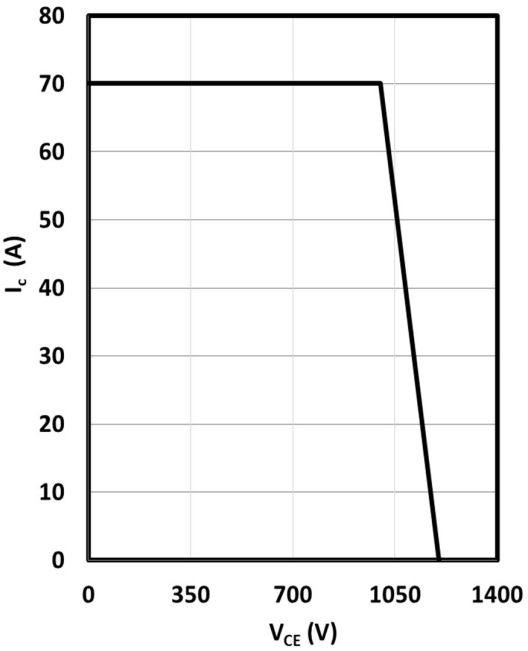


Fig. 5 RBSOA

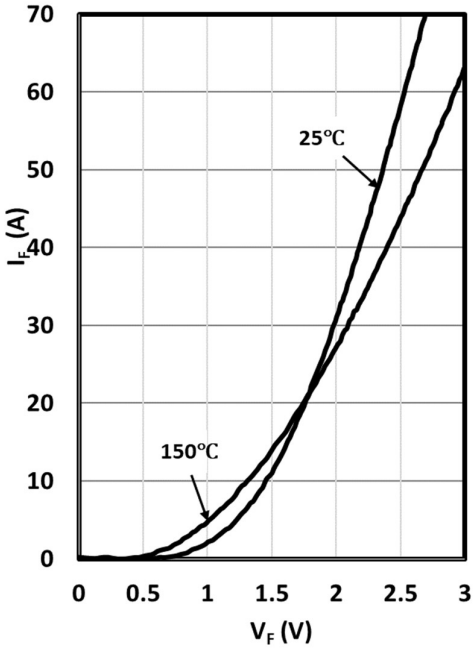


Fig. 6 Diode (Inverter) Forward Characteristics

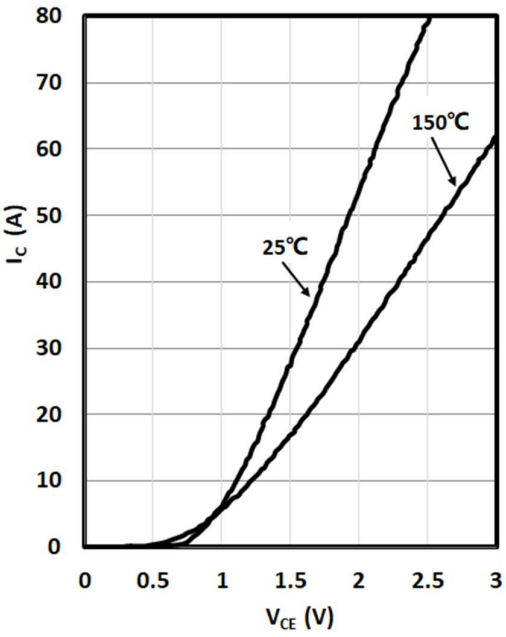


Fig. 7 IGBT (Brake-Chopper) Output Characteristics

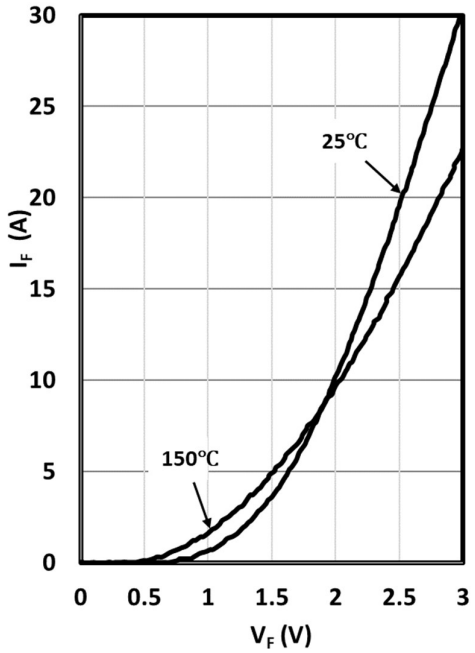


Fig. 8 Diode (Brake-Chopper) Output Characteristics

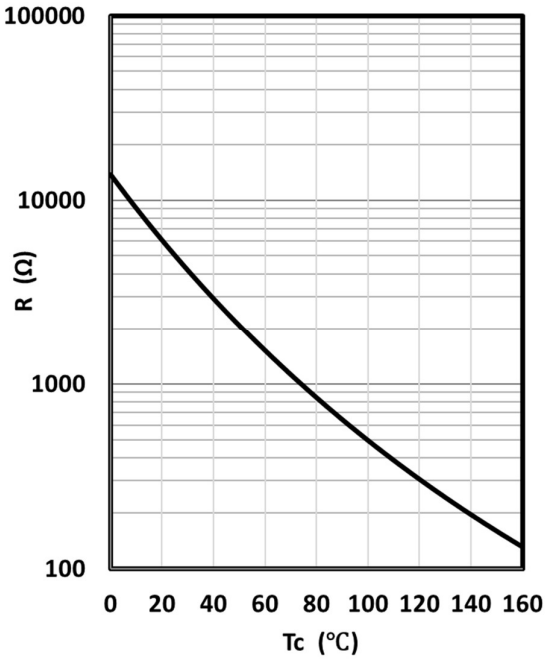
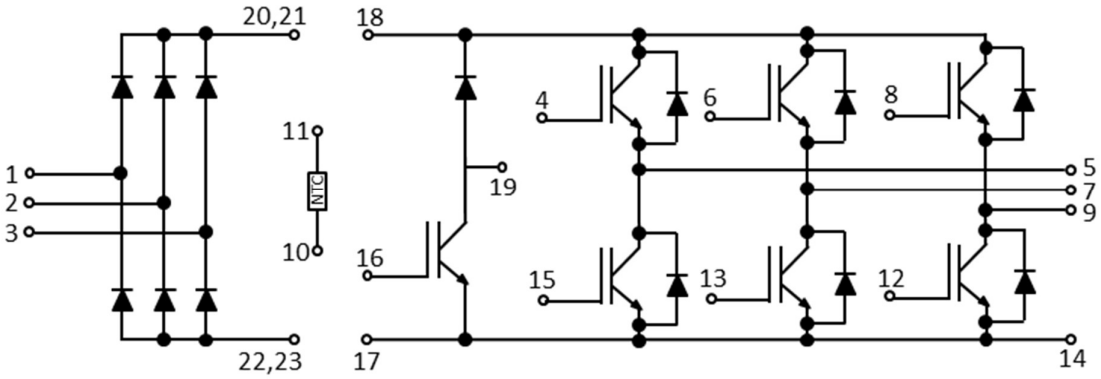
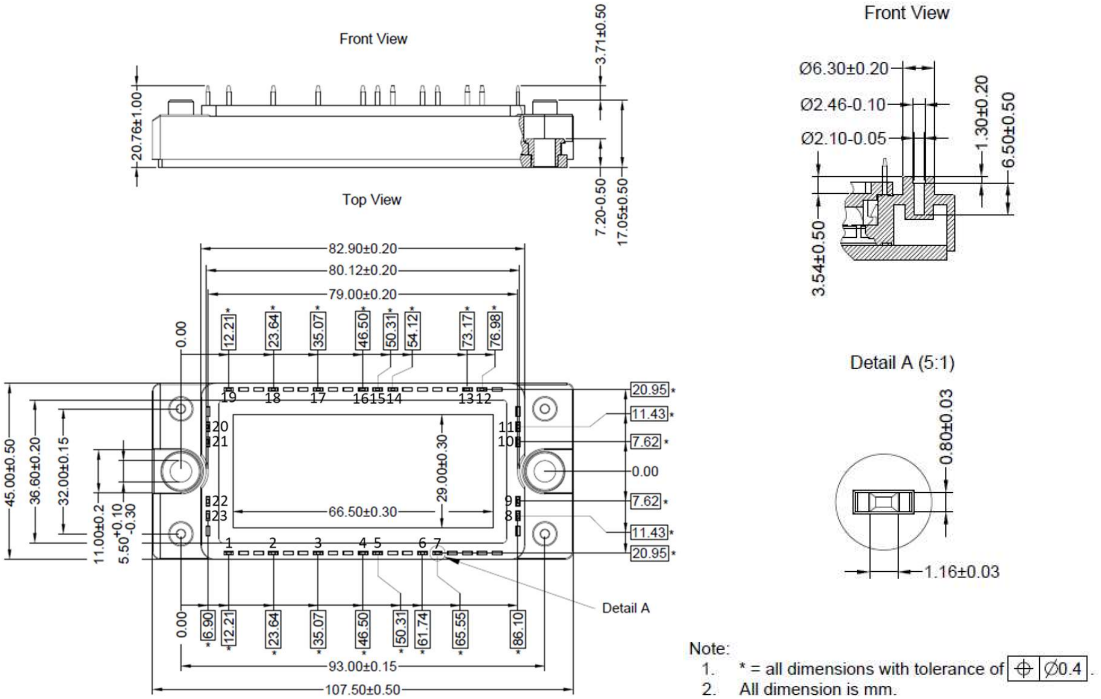


Fig. 9 NTC Temperature Characteristics

- **Circuit diagram**



- **Package Dimensions**



Revision history of JG1D35P120FA2 Specification

Version	Change Items	Effective Date
1.00	Initial Release	30-Mar-21

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