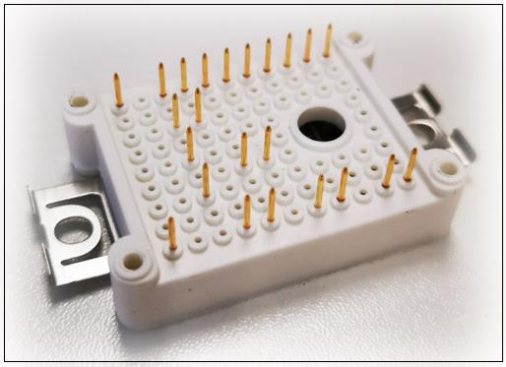
Features

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

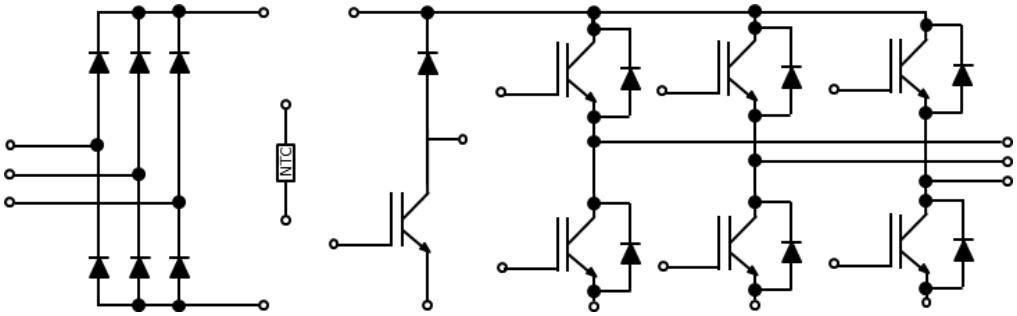
Product Summary	
V_{CES}	1200V
I_C	15A
$V_{CE(sat),typ}$	1.7V



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 ($t_p \le 10\mu s$, D < 0.010)		±30	
Continuous DC Collector Current (T_c = 100°C, T_J = 175°C)	I_{CDC}	15	A
Repetitive Peak Collector Current (t_p = 1ms)	I_{CRM}	30	
Maximum Power Dissipation (T_c = 25°C, T_J = 175°C)	$P_{D(max)}$	112	W

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	4.8	6.0	7.2	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C = 15A	-	1.7	2.05	V
		V_{GE} = 15V, I_C = 15A, T_J = 150°C	-	2.1	-	
		V_{GE} = 15V, I_C = 15A, T_J = 175°C	-	2.2	-	
Total Gate Charge	Q_g	V_{CC} = 600V, V_{GE} = ±15V, I_C = 15A	-	142	-	nC
Input Capacitance	C_{iss}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1617	-	pF
Output Capacitance	C_{oss}		-	44	-	
Reverse Transfer Capacitance	C_{rss}		-	19	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 1Ω, I_C = 15A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery.	-	16	-	ns
Rise Time	t_r		-	26	-	
Turn-off Delay time	$t_{d(OFF)}$		-	166	-	
Fall Time	t_f		-	183	-	
Turn-On Switching Loss	E_{on}		-	0.69	-	mJ
Turn-Off Switching Loss	E_{off}		-	0.89	-	
IGBT Total Switching Loss	E_{ts}		-	1.58	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 1Ω, I_C = 15A, L_{load} = 0.82mH, Energy losses include “tail” and diode reverse recovery. T_J = 150°C	-	18	-	ns
Rise Time	t_r		-	29	-	
Turn-off Delay time	$t_{d(OFF)}$		-	170	-	
Fall Time	t_f		-	185	-	
Turn-On Switching Loss	E_{on}		-	1.16	-	mJ
Turn-Off Switching Loss	E_{off}		-	1.13	-	
IGBT Total Switching Loss	E_{ts}		-	2.29	-	
Short Circuit Collector Current	$I_{C(SC)}$	V_{GE} = 15V, V_{CC} ≤ 600V, t_{SC} ≤ 10μs	-	75	-	A

• Diode, Inverter

Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	1200	V
Continuous DC Forward Current	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 = 150°C	-	1.75	-	
		I_F = 15A, T_J = 175°C	-	1.7	-	
Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 15A, dI_F/dt = - 530 A/µs	-	1.2	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	14	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.25	-	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 ≤ 10µs, D < 0.010)		±30	
Continuous DC Collector Current (T_c = 100°C, T_J = 175°C)	I_{CDC}	15	A
Repetitive Peak Collector Current (t_p = 1ms)	I_{CRM}	30	

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	4.8	6.0	7.2	V

Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C = 15A	-	1.7	2.05	V
		V_{GE} = 15V, I_C = 15A, T_J = 150°C	-	2.1	-	
		V_{GE} = 15V, I_C = 15A, T_J = 175°C	-	2.15	-	
Total Gate Charge	Q_g	V_{CC} = 600V, V_{GE} = ±15V, I_C = 15A	-	142	-	nC
Input Capacitance	C_{iss}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1617	-	pF
Output Capacitance	C_{oss}		-	44	-	
Reverse Transfer Capacitance	C_{rss}		-	19	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 1Ω, I_C = 15A, L_{load} = 0.82mH, Energy losses include "tail" and diode reverse recovery.	-	16	-	ns
Rise Time	t_r		-	26	-	
Turn-off Delay time	$t_{d(OFF)}$		-	166	-	
Fall Time	t_f		-	183	-	
Turn-On Switching Loss	E_{on}		-	0.69	-	mJ
Turn-Off Switching Loss	E_{off}		-	0.89	-	
IGBT Total Switching Loss	E_{ts}		-	1.58	-	
Turn-on Delay time	$t_{d(ON)}$	V_{CC} = 600V, V_{GE} = ±15V, R_G = 1Ω, I_C = 15A, L_{load} = 0.82mH, Energy losses include "tail" and diode reverse recovery. T_J = 150°C	-	18	-	ns
Rise Time	t_r		-	29	-	
Turn-off Delay time	$t_{d(OFF)}$		-	170	-	
Fall Time	t_f		-	185	-	
Turn-On Switching Loss	E_{on}		-	1.16	-	mJ
Turn-Off Switching Loss	E_{off}		-	1.13	-	
IGBT Total Switching Loss	E_{ts}		-	2.29	-	
Short Circuit Collector Current	$I_{C(SC)}$	V_{GE} = 15V, V_{CC} ≤ 600V, t_{SC} ≤ 10μs	-	75	-	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	10	A
Repetitive Peak Forward Current (t_P = 1ms)	I_{FRM}	20	

Electrical Characteristics (1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 10A	-	2.05	2.4	V
		I_F = 10A T_J = 150°C	-	1.5	-	
		I_F = 10A T_J = 175°C	-	1.45	-	
Diode Reverse-Recovery Charge	Q_{rr}	V_R = 600V, I_F = 10A, dI_F/dt = - 600 A/µs	-	0.8	-	µC
Diode Peak Reverse-Recovery Current	I_{rrm}		-	11.0	-	A
Diode Reverse-Recovery Loss	E_{rr}		-	0.22	-	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)	$I_{F(AV)}$	15	A
Maximum RMS Current at Rectifier Output (T_c = 100°C)	I_{RMSM}	30	
Surge Forward Current (V_R = 0, t_P = 10ms)	I_{FSM}	220	
I^2t – value (V_R = 0, t_P = 10ms)	I^2t	242	A^2s

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	I_F = 15A T_J = 150°C	-	1.1	-	V
Diode Threshold Voltage	V_{TO}	T_J =150°C	-	0.75	-	
Diode Slope Resistance	r_T	T_J =150°C	-	26	-	mΩ
Diode Reverse Current	I_R	V_R = 1600V T_J = 150°C	-	-	1.0	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 (RMS, 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	$R_{CC'+EE'}$	-	8.0	-	mΩ
Module Lead Resistance, Terminal to Chip	$R_{AA'+CC'}$	-	6.0	-	
Junction-to-Case Thermal Resistance, per IGBT, Inverter	$R_{\theta JC}$	-	1.12	-	°C/W
Junction-to-Case Thermal Resistance, per Diode, Inverter		-	1.75	-	
Junction-to-Case Thermal Resistance, per IGBT, Brake-Chopper		-	1.12	-	
Junction-to-Case Thermal Resistance, per Diode, Brake-Chopper		-	1.75	-	
Junction-to-Case Thermal Resistance, per Diode, Rectifier		-	1.10	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Inverter	$R_{\theta CH}$	-	1.15	-	°C/W
Case-to-Heatsink Thermal Resistance, per Diode, Inverter		-	1.30	-	
Case-to-Heatsink Thermal Resistance, per IGBT, Brake-Chopper		-	1.15	-	
Case-to-Heatsink Thermal Resistance, per Diode, Brake-Chopper		-	1.30	-	
Case-to-Heatsink Thermal Resistance, per Diode, Rectifier		-	1.20	-	
Case-to-Heatsink Thermal Resistance, per Module		-	0.058	-	
Mounting Force per Clamp	F	20	-	50	N
Weight per Module	G	-	25	-	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

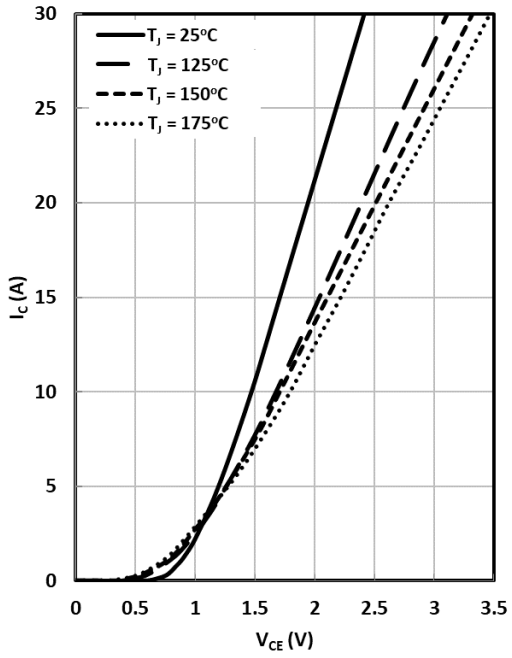


Fig. 1 IGBT (Inverter) Output Characteristics

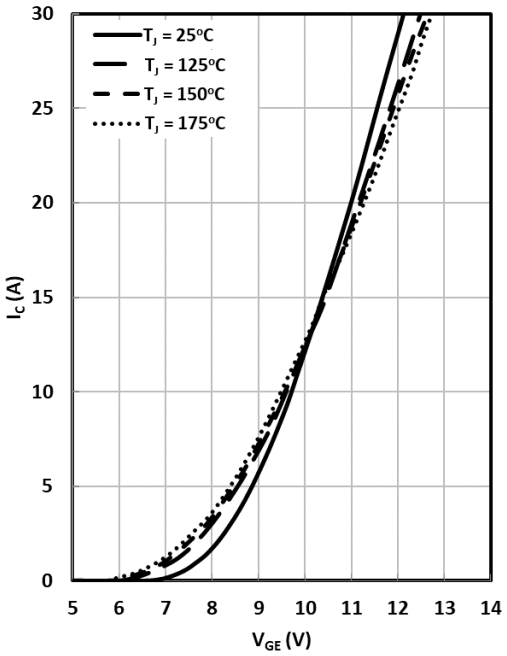


Fig. 2 IGBT (Inverter) Transfer Characteristics

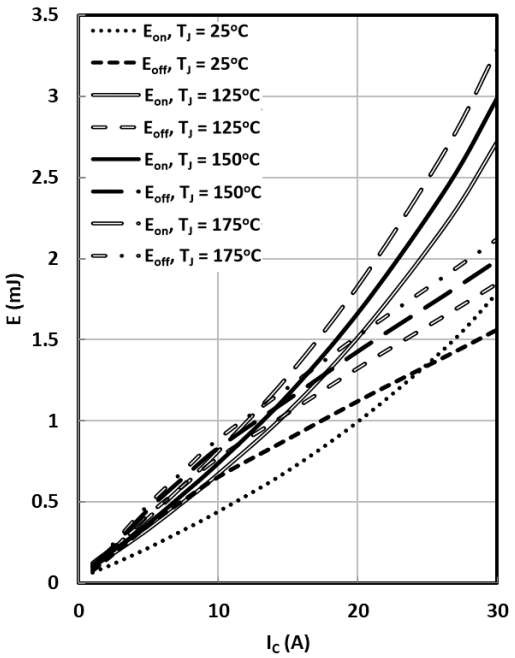


Fig. 3 IGBT (Inverter) Switching Loss vs. I_C

(V_{CC} = 600V, V_{GE} = ±15V, R_G = 1Ω)

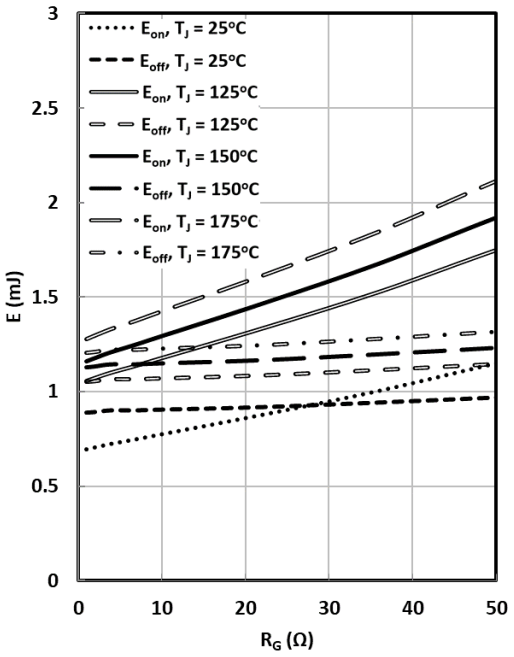


Fig. 4 IGBT (Inverter) Switching Loss vs. R_G

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

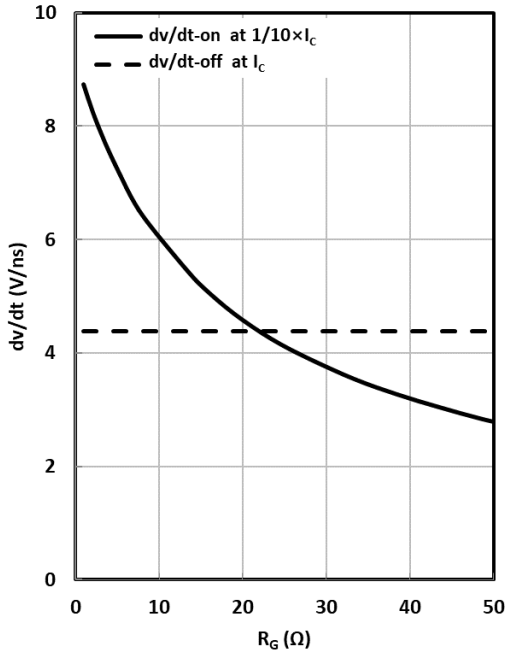


Fig. 5 IGBT (Inverter) dv/dt

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

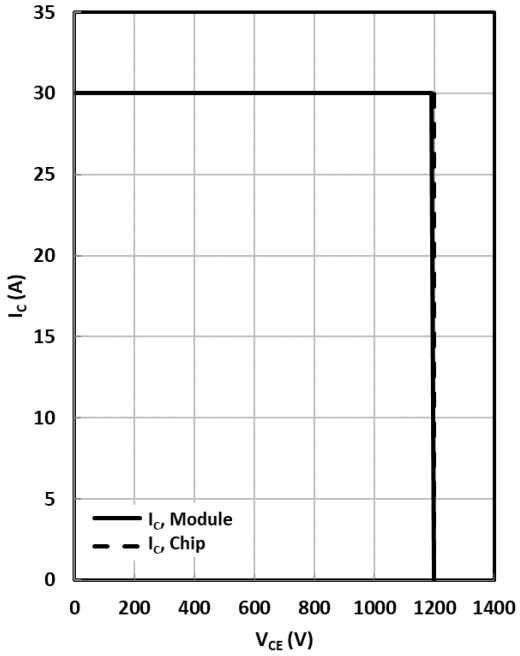


Fig. 6 RBSOA

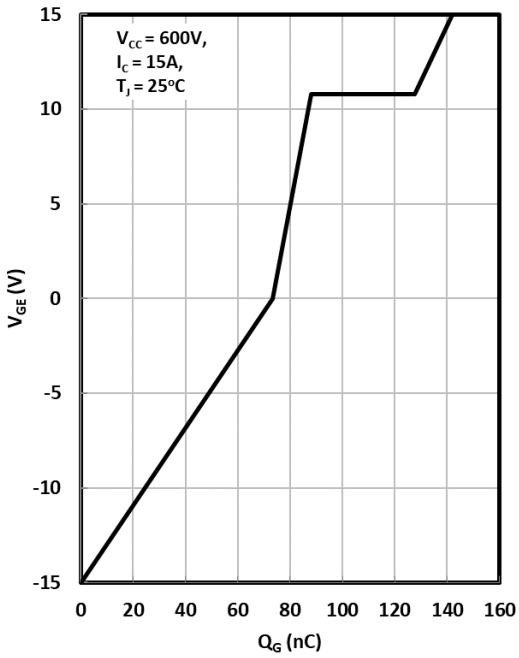


Fig. 7 IGBT (Inverter) Gate Charge Characteristics

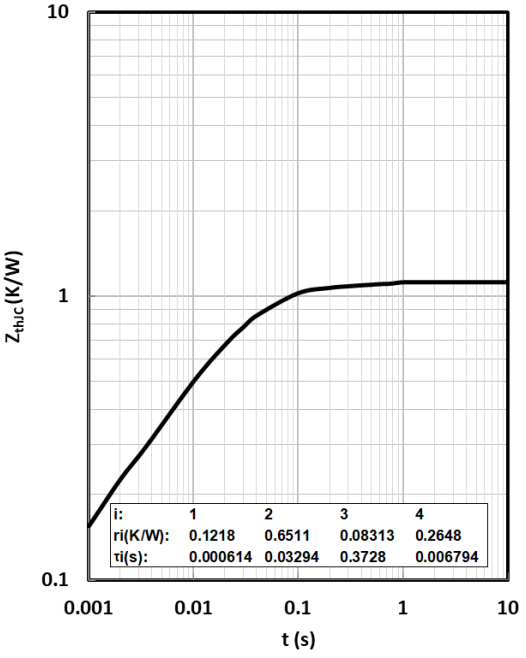


Fig. 8 IGBT (Inverter) Transient Thermal Impedance

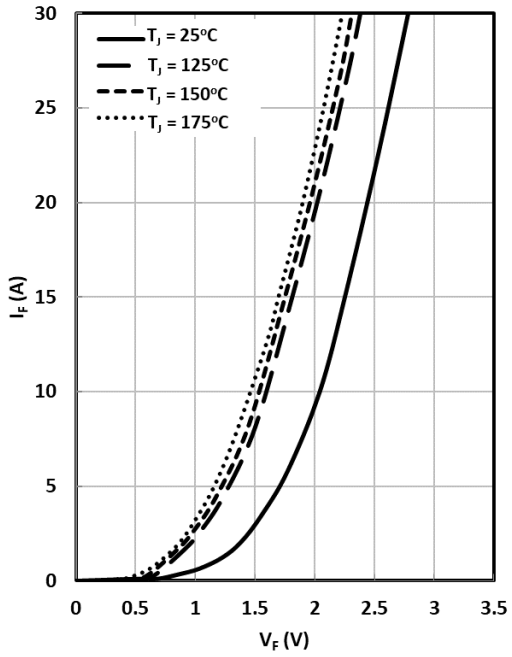


Fig. 9 Diode (Inverter) Forward Characteristics

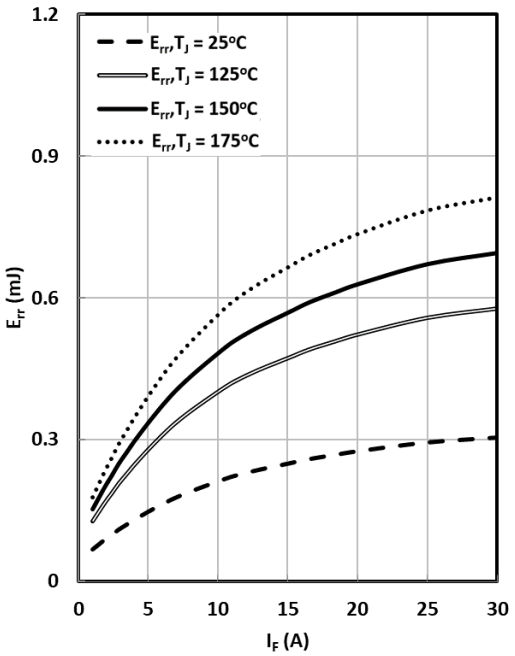


Fig. 10 Diode (Inverter) Switching Loss vs. I_F

(V_{CC} = 600V, R_G = 1Ω)

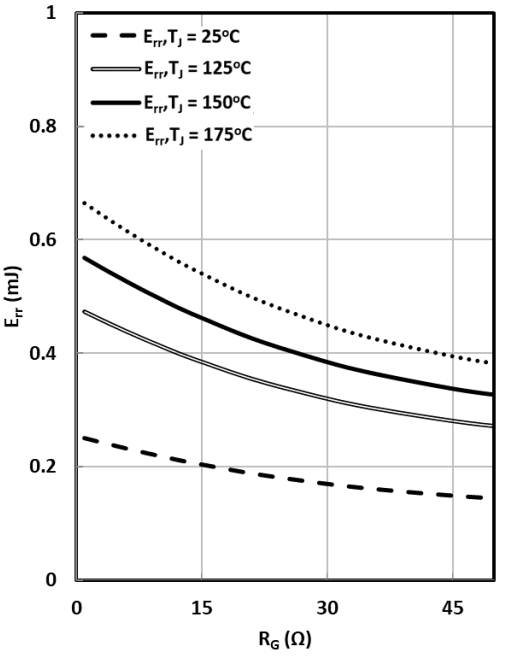


Fig. 11 Diode (Inverter) Switching Loss vs. R_G

(V_{CC} = 600V, I_F = 15A)

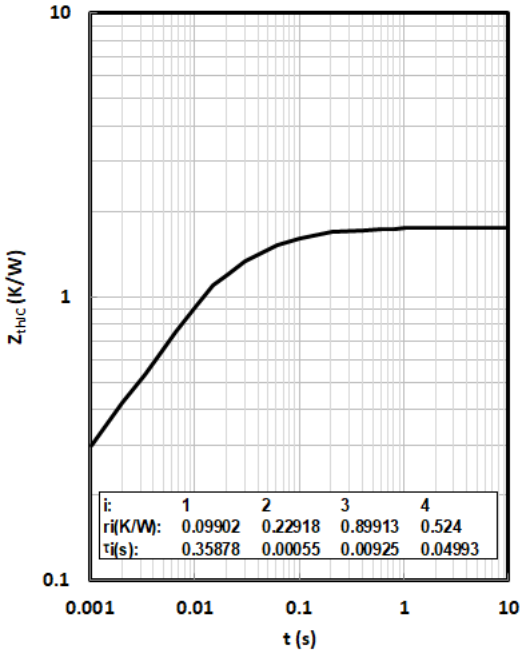


Fig. 12 Diode(Inverter) Transient Thermal Impedance

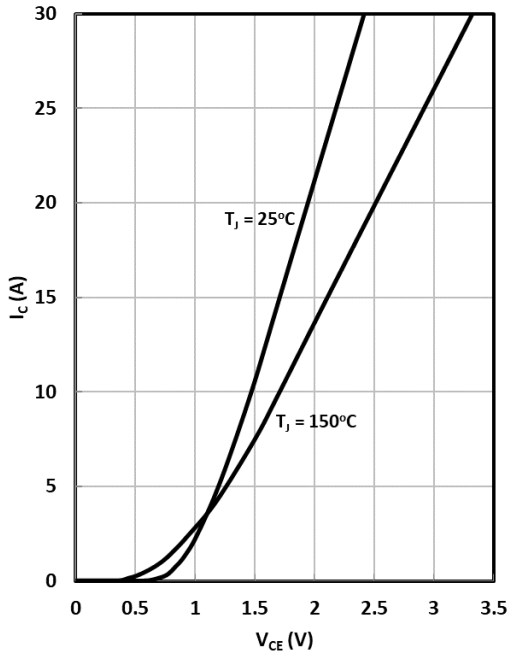


Fig. 13 IGBT (Brake-Chopper) Output Characteristics

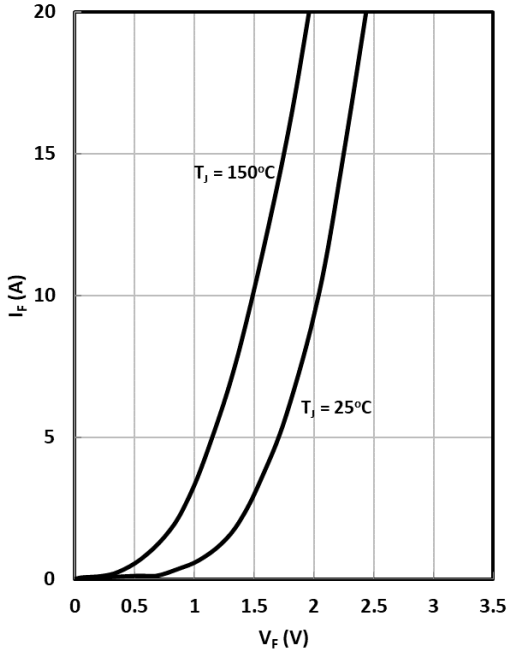


Fig. 14 Diode (Brake-Chopper) Output Characteristics

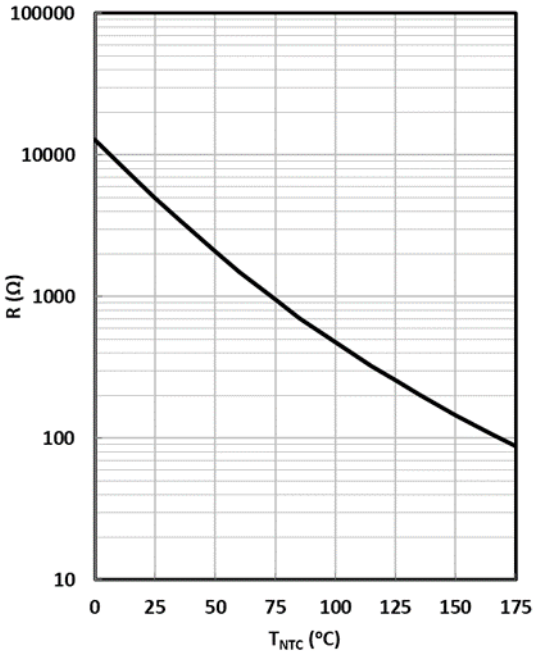


Fig. 15 NTC Temperature Characteristics

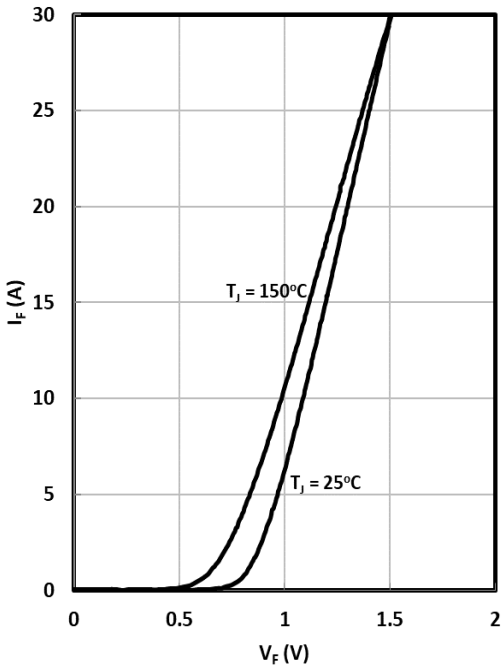
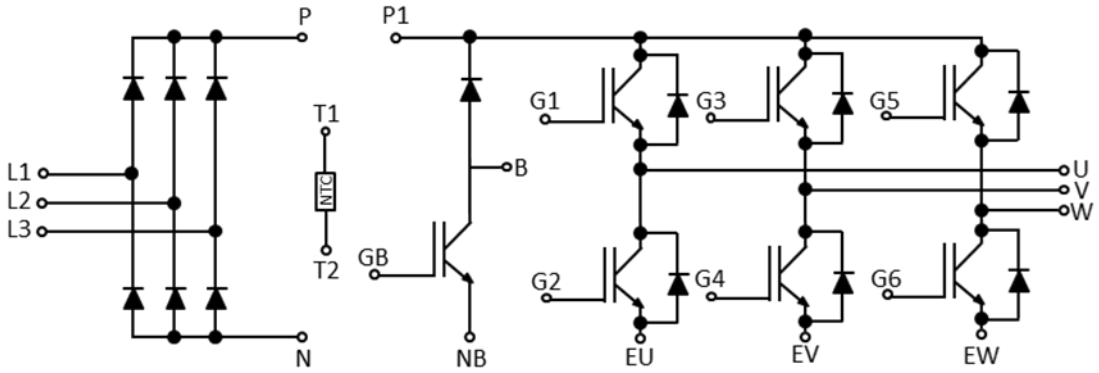
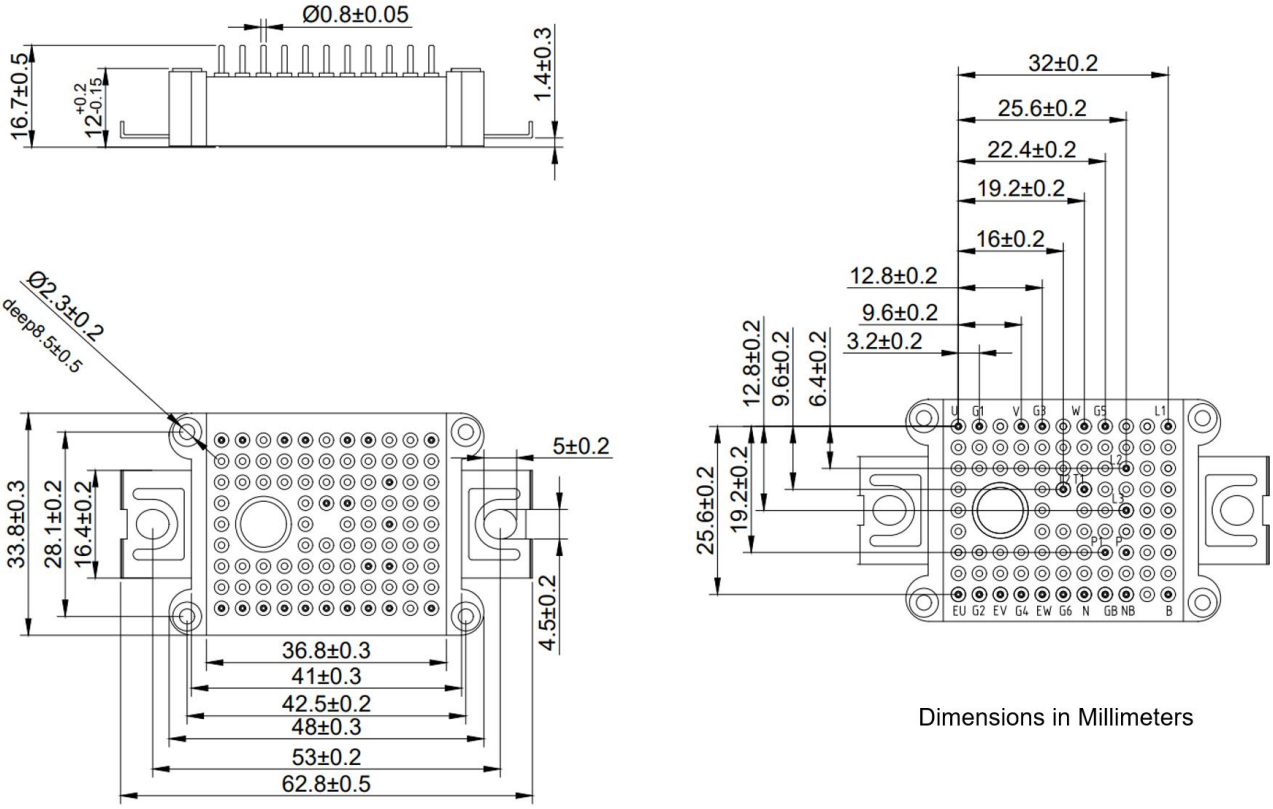


Fig. 16 Diode (Rectifier) Forward Characteristics

- **Circuit diagram**



- **Package Dimensions**



Dimensions in Millimeters

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