

## PIM IGBT Module

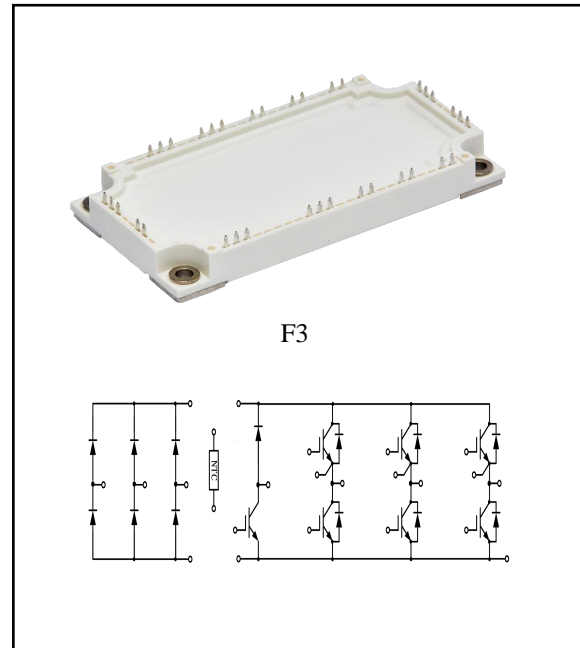
$V_{CES} = 1200V$ ,  $I_{C\ nom} = 100A / I_{CRM} = 200A$

### Electrical characteristics :

- 1200V Trench /Field Stop process
- Low switching losses
- $V_{cesat}$  has a positive temperature coefficient

### Applications:

- Power Converters
- Servo Drives
- Inverter



## IGBT, Inverter

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj} = 25^{\circ}C$	$V_{CES}$	1200	V
Continuous DC collector current	$T_C = 100^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	100	A
Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	200	A
Total power dissipation	$T_C = 25^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$P_{tot}$	515	W
Gate emitter voltage		$V_{GE}$	$\pm 20$	V

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
Collector-Emitter saturation voltage	$V_{GE}=15V, I_C=100A$	$T_{vj}=25^{\circ}C$		1.92	2.50	V	
	$V_{GE}=15V, I_C=100A$	$T_{vj}=125^{\circ}C$		2.34			
	$V_{GE}=15V, I_C=100A$	$T_{vj}=150^{\circ}C$		2.44			
Gate-Emitter threshold voltage	$I_C=3.8mA, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	$V_{GE(th)}$	5.20	5.80	6.40	
Gate charge	$V_{GE}=-15V\dots+15V$		$Q_G$		0.47		$\mu C$
Internal gate resistor	$T_{vj}=25^{\circ}C$		$R_{Gint}$		5.86		$\Omega$
Input capacitance	$f=1MHz, V_{CE}=25V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	$C_{ies}$		7.47		nF
Reverse transfer capacitance			$C_{res}$		0.28		
Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	$I_{CES}$			1	mA
Gate-emitter leakage current	$V_{CE}=0V, V_{GE}=20V$	$T_{vj}=25^{\circ}C$	$I_{GES}$			100	nA
Turn-on delay time	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$t_{don}$		104		
					113		
					118		
Rise time	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$t_r$		27		ns
					32		
					34		
Turn-off delay time	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$t_{doff}$		203		
					251		
					259		
Fall time	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$t_f$		181		
					184		
					197		
Turn-on energy loss per pulse	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ $di/dt=2300A/\mu s$ ( $T_{vj}=150^{\circ}C$ ) (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$E_{on}$		3.04		mJ
					6.17		
					7.22		
Turn-off energy loss per pulse	$I_C=100A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=2\Omega$ $du/dt=5000V/\mu s$ ( $T_{vj}=150^{\circ}C$ ) (inductive load)	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$	$E_{off}$		6.11		
					8.24		
					8.77		
SC data	$V_{GE}\leq 15V, V_{CC}=800V$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$	$t_p\leq 10\mu s, T_{vj}=150^{\circ}C$	$I_{SC}$		329		A
Temperature under switching conditions			$T_{vj op}$	-40		150	$^{\circ}C$

## Diode, Inverter

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$	$V_{RRM}$	1200	V
Continuous DC forward current		$I_F$	100	A
Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	200	A
$I^2t$ -value	$t_p=10\text{ms}$ , $\sin 180^{\circ}$ , $T_j=125^{\circ}\text{C}$	$I^2t$	1360	$\text{A}^2\text{s}$

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=100\text{A}$ , $V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$V_F$		2.20	2.80	V
	$I_F=100\text{A}$ , $V_{GE}=0\text{V}$ $T_{vj}=125^{\circ}\text{C}$		2.15			
	$I_F=100\text{A}$ , $V_{GE}=0\text{V}$ $T_{vj}=150^{\circ}\text{C}$		2.07			
Peak reverse recovery current	$I_F=100\text{A}$ , $-di_F/dt=2300\text{A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ ) $V_R=600\text{V}$ , $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$I_{RM}$		109	A	
	$T_{vj}=125^{\circ}\text{C}$		121			
	$T_{vj}=150^{\circ}\text{C}$		124			
Recovered charge	$I_F=100\text{A}$ , $-di_F/dt=2300\text{A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ ) $V_R=600\text{V}$ , $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$Q_r$		6.04	$\mu\text{C}$	
	$T_{vj}=125^{\circ}\text{C}$		12.58			
	$T_{vj}=150^{\circ}\text{C}$		15.34			
Reverse recovered energy	$I_F=100\text{A}$ , $-di_F/dt=2300\text{A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ ) $V_R=600\text{V}$ , $V_{GE}=-15\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$E_{rec}$		2.09	mJ	
	$T_{vj}=125^{\circ}\text{C}$		4.72			
	$T_{vj}=150^{\circ}\text{C}$		5.79			
Temperature under switching conditions		$T_{vj\text{op}}$	-40		150	$^{\circ}\text{C}$

## Diode, Rectifier

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$ , $I_{RRM}=5\mu\text{A}$	$V_{RRM}$	1800	V
Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$ , $I_{RRM}=5\mu\text{A}$	$V_{RSM}$	2000	V
Maximum Average Forward Current		$I_{F(AV)}$	80	A
Surge forward current	$t_p=10\text{ms}$ , $\sin 180^{\circ}$ , $T_j=25^{\circ}\text{C}$	$I_{FSM}$	960	A
$I^2t$ -value	$t_p=10\text{ms}$ , $\sin 180^{\circ}$ , $T_j=25^{\circ}\text{C}$	$I^2t$	4600	$\text{A}^2\text{s}$

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=80A, T_J=25^\circ C$	$V_F$		1.10	1.20	V
Reverse current	$V_R=V_{RRM} \quad T_{vj}=25^\circ C$	$I_R$			10	$\mu A$
Temperature under switching conditions		$T_{vj\ op}$	-40		150	$^\circ C$

## IGBT, Brake-Chopper

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj}=25^\circ C$	$V_{CES}$	1200	V
Continuous DC collector current	$T_C=100^\circ C, T_{vj\ max}=175^\circ C$	$I_{C\ nom}$	50	A
Repetitive peak collector current	$t_p=1\ ms$	$I_{CRM}$	100	A
Total power dissipation	$T_C = 25^\circ C, T_{vj\ max} = 175^\circ C$	$P_{tot}$	270	W
Gate emitter voltage		$V_{GE}$	$\pm 20$	V

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15V, I_C=50A \quad T_{vj}=25^\circ C$ $V_{GE}=15V, I_C=50A \quad T_{vj}=125^\circ C$ $V_{GE}=15V, I_C=50A \quad T_{vj}=150^\circ C$	$V_{CEsat}$		2.10 2.53 2.61	2.90	V
Gate-Emitter threshold voltage	$I_C=1.6mA, V_{GE}=V_{CE} \quad T_{vj}=25^\circ C$	$V_{GE(th)}$	5.20	5.80	6.40	
Gate charge	$V_{GE}=-15V\dots+15V$	$Q_G$		0.24		$\mu C$
Internal gate resistor	$T_{vj}=25^\circ C$	$R_{Gint}$		2.78		$\Omega$
Input capacitance	$f=1MHz, V_{CE}=25\ V, V_{GE}=0\ V \quad T_{vj}=25^\circ C$	$C_{ies}$		2.96		nF
Reverse transfer capacitance		$C_{res}$		0.11		
Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0\ V \quad T_{vj}=25^\circ C$	$I_{CES}$			1	mA
Gate-emitter leakage current	$V_{CE}=0\ V, V_{GE}=20\ V \quad T_{vj}=25^\circ C$	$I_{GES}$			100	nA

Turn-on delay time	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_{d\ on}$		56 60 61	ns
Rise time	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_r$		36 43 45	
Turn-off delay time	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_{d\ off}$		189 235 245	
Fall time	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$t_f$		184 221 244	
Turn-on energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ $di/dt=800A/\mu s$ ( $T_{vj}=150^\circ C$ ) (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{on}$		3.50 5.83 6.59	mJ
Turn-off energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=15\Omega$ $du/dt=5600V/\mu s$ ( $T_{vj}=150^\circ C$ ) (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{off}$		2.93 4.05 4.42	
SC data	$V_{GE}\leq 15V, V_{cc}=800V$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 10\mu s, T_{vj}=150^\circ C$		$I_{sc}$		190	A
Temperature under switching conditions			$T_{vj\ op}$	-40		150 °C

## Diode, Brake-Chopper

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^\circ C$	$V_{RRM}$	1200	V
Continuous DC forward current		$I_F$	30	A
Repetitive peak forward current	$t_p=1ms$	$I_{FRM}$	60	A
$I^2t$ -value	$t_p=10ms, \sin 180^\circ, T_{vj}=125^\circ C$	$I^2t$	120	$A^2s$

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=30A, V_{GE}=0V$	$T_{vj}=25^{\circ}C$		1.94	2.40	V
	$I_F=30A, V_{GE}=0V$	$T_{vj}=125^{\circ}C$		1.64		
	$I_F=30A, V_{GE}=0V$	$T_{vj}=150^{\circ}C$		1.57		
Peak reverse recovery current	$I_F=30A,$	$T_{vj}=25^{\circ}C$		20		A
	$-di_F/dt=800A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$		29		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$		31		
Recovered charge	$I_F=30A,$	$T_{vj}=25^{\circ}C$		2.04		$\mu C$
	$-di_F/dt=800A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$		5.23		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$		6.18		
Reverse recovered energy	$I_F=30A,$	$T_{vj}=25^{\circ}C$		0.95		mJ
	$-di_F/dt=800A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$		2.01		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$		2.28		
Temperature under switching conditions		$T_{vj\ op}$	-40		150	$^{\circ}C$

## NTC-Thermistor

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Rated resistances	$T_c=25^{\circ}C, \pm 5\%$	$R_{25}$		5.0		$K\Omega$
B-value	$\pm 2\%$	$B_{25/50}$		3375		K

## Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, $f=50Hz, t=1min$	$V_{ISOL}$	2500			V
Internal isolation			$Al_2O_3$			
Storage temperature		$T_{stg}$	-40		125	$^{\circ}C$
Mounting torque for modul mounting		M	3.0		6.0	Nm
Weight		W		300		g

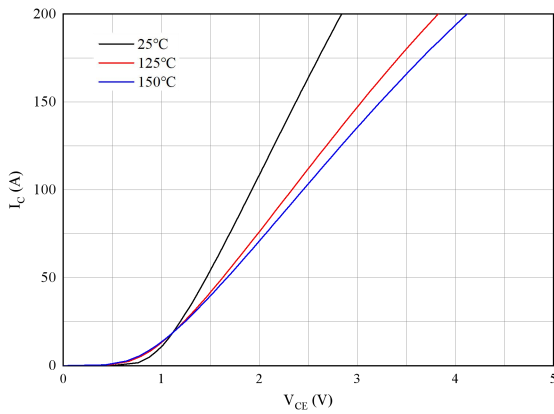


Fig 1. Typical output characteristics ( $V_{GE}=15V$ )

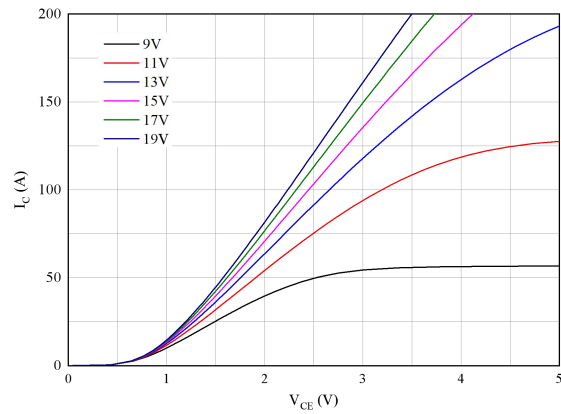


Fig 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

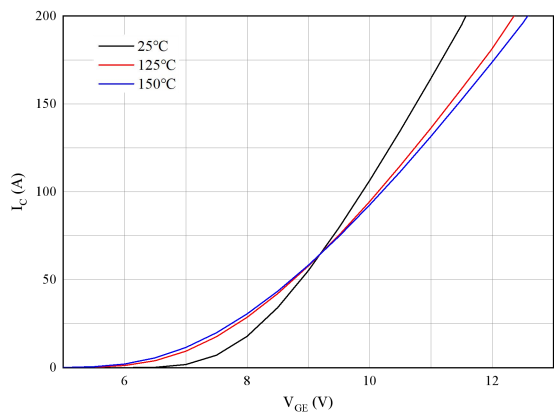


Fig 3. Typical transfer characteristic ( $V_{CE}=20V$ )

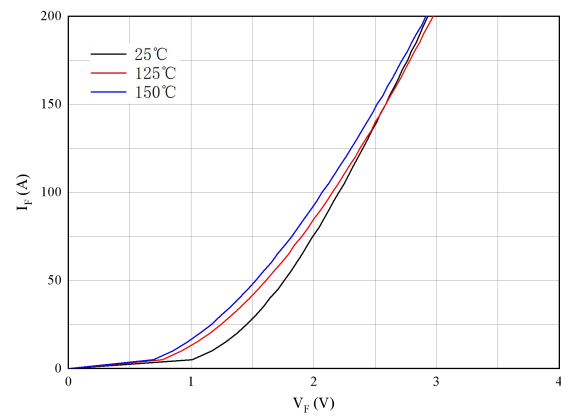


Fig 4. Forward characteristic of Diode

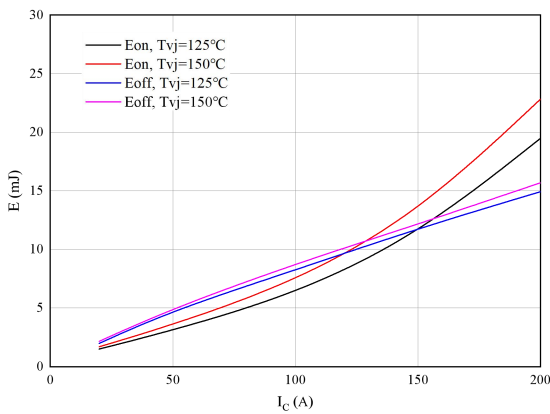


Fig 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=2\Omega, R_{Goff}=2\Omega, V_{CE}=600V$

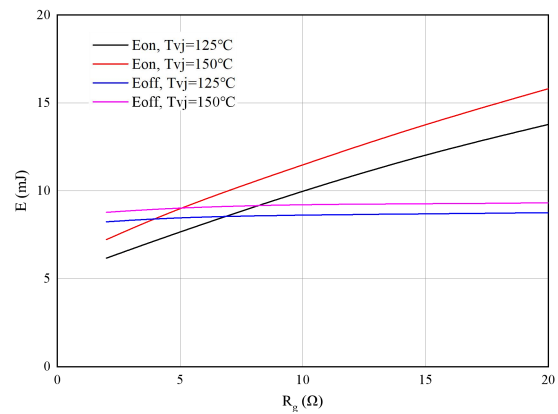
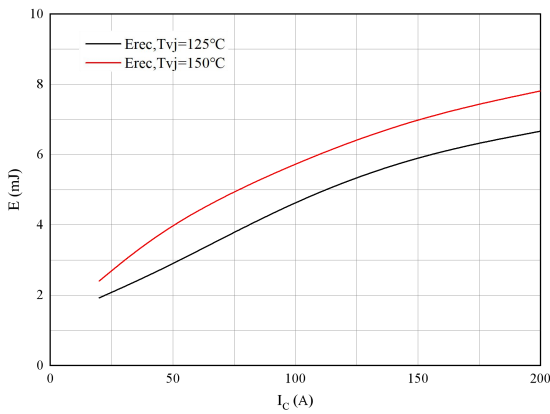
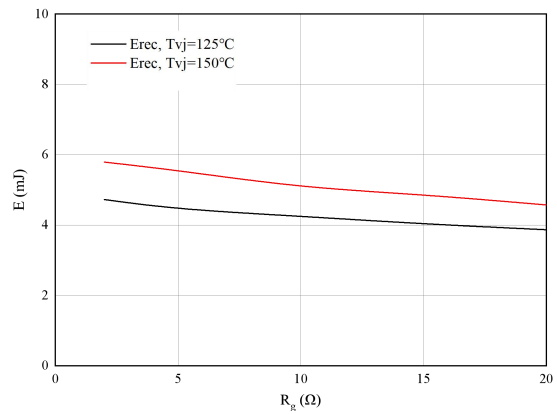


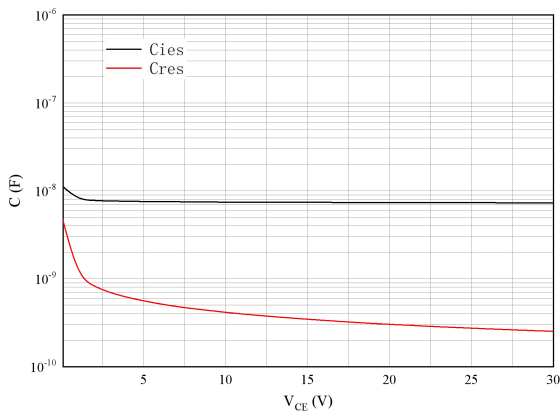
Fig 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=100A, V_{CE}=600V$



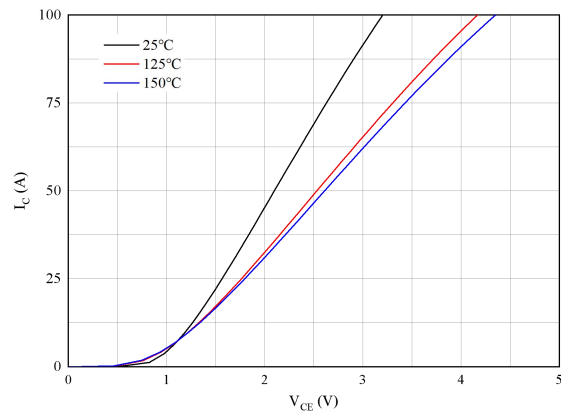
**Fig 7. Switching losses of Diode**  
 $R_{Gon}=2\Omega, V_{CE}=600V$



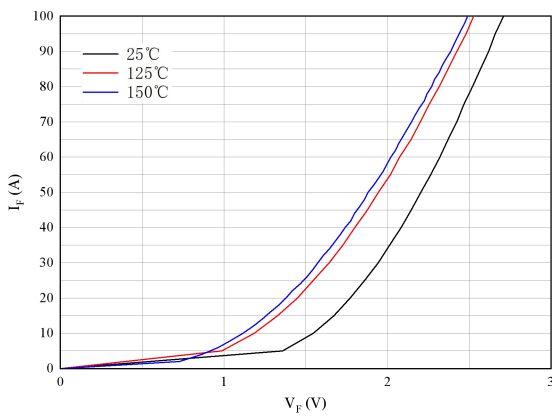
**Fig 8. Switching losses of Diode**  
 $I_F=100A, V_{CE}=600V$



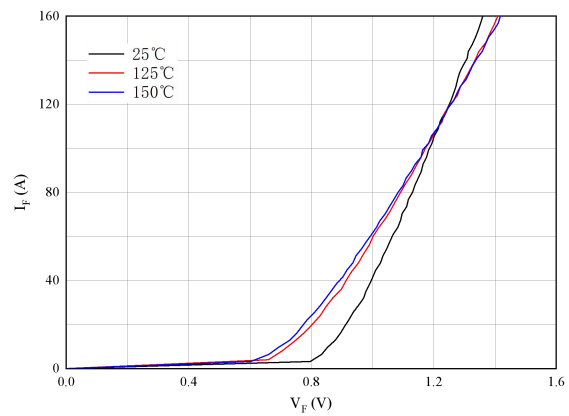
**Fig 9. Capacitance characteristics**



**Fig 10. Typical output characteristics ( $V_{GE}=15V$ )**



**Fig 11. Forward characteristic of Diode**



**Fig 12. Forward characteristic of Diode**



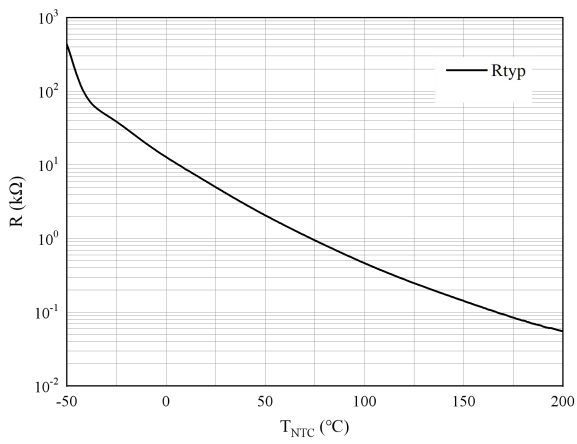
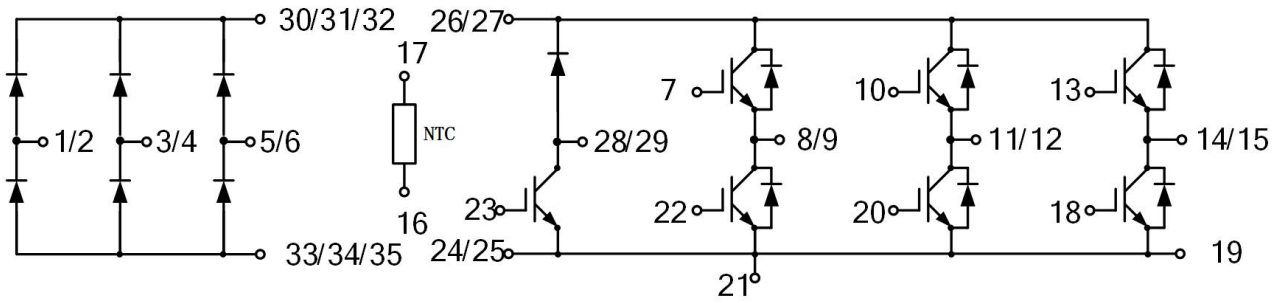


Fig 13. NTC-Themistor-temperature characteristic

**Circuit diagram**



**Package outlines**

