

PIM with Trench Field-Stop IGBT, Emitter Controlled Diode and NTC

Features

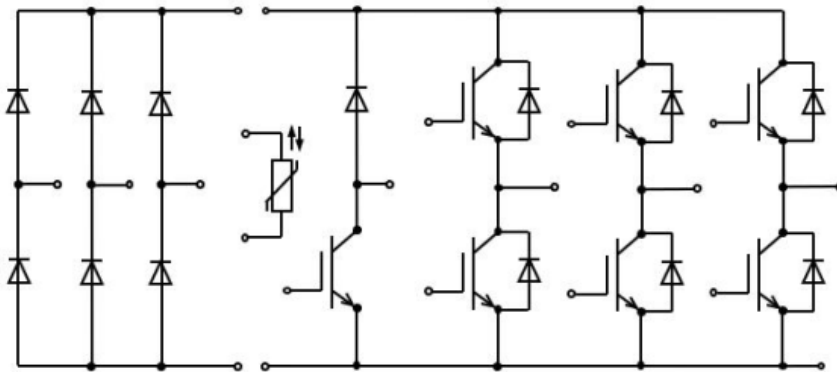
- $V_{CE}=1200V$ $I_C=25A$
- Low $V_{CE(sat)}$ with Positive Temperature Coefficient
- Maximum junction temperature $150^{\circ}C$

Applications

- The inverter
- Motor control and drives



Equivalent Circuit Schematic



IGBT - Inverter

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj}=25^{\circ}C$	1200	V
V_{GES}	Gate-Emitter Peak Voltage	$T_{vj}=25^{\circ}C$	± 30	V
I_C	Continuous DC Collector Current	$T_C=100^{\circ}C$	25	A
I_{CRM}	Repetitive Peak Collector Current	$t_p=1ms$	50	A
P_{tot}	Total Power Dissipation	$T_C=25^{\circ}C, T_{vj\ max}=150^{\circ}C$	87	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=25A, T_{vj}=25^{\circ}C$	1.7	1.85	2.5	V
		$V_{GE}=15V, I_C=25A, T_{vj}=125^{\circ}C$	---	2.53	2.7	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=5.0mA$	5.2	6.0	6.5	V
I_{CES}	Collector-Emitter Cut-Off Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	20	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20V, V_{CE}=0V$	---	---	200	nA
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V$ $V_{GE}=\pm 15V$ $I_C=25A$ $R_G=20\Omega$ Inductive Load $T_{vj}=25^{\circ}C$	---	138	---	ns
t_r	Turn-on Rise Time		---	94	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	220	---	ns
t_f	Turn-off Fall Time		---	152	---	ns
E_{on}	Turn-on Switching Loss		---	3.53	---	mJ
E_{off}	Turn-off Switching Loss		---	1.23	---	mJ
I_{SC}	Short Circuit data	$V_{GE}=15V, V_{CC}=600V$ $t_p=10\mu s, T_{vj}=125^{\circ}C$	---	100	---	A
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	1.45	K/W
T_{VJOP}	Virtual Junction Temperature	Under Switching	-40	---	125	$^{\circ}C$

**Diode - Inverter
Maximum Rated Values**

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1200	V
I_F	Continuous DC Forward Current	$T_C=100^{\circ}C$	25	A
I_{FRM}	Repetitive Peak Collector Current	$t_p=1ms$	50	A
I^2t	I^2t Value	$t_p=10ms, V_R=0V, T_j=125^{\circ}C$	220	A^2s

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V _F	Forward Voltage	I _F =25A, V _{GE} =0V, T _{vj} =25°C	---	1.85	2.5	V
		I _F =25A, V _{GE} =0V, T _{vj} =125°C	---	1.85	2.5	V
t _{rr}	Reverse Recovery Time	I _F =25A, -di/dt=100A/us V _R =600V, V _{GE} =-15V T _{vj} =25°C	---	170	---	ns
Q _r	Recovered Charge		---	0.98	---	uC
E _{rec}	Reverse Recovery Energy		---	0.35	---	mJ
R _{thJC}	Thermal Resistance, Junction to Case	Per Diode	---	---	1.0	K/W
T _{VJ OP}	Virtual Junction Temperature	Under Switching	-40	---	125	°C

**Diode - Rectifier
Maximum Rated Values**

Symbol	Description	Conditions	Values	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	T _{vj} =25°C	1600	V
I _{FRMSM}	Maximum RMS forward current Per chip	T _{vj} =80°C	25	A
I _{RMSM}	Maximum RMS current at Rectifier output	T _{vj} =80°C	100	A
I _{FSM}	Surge Forward Current	t _p =10ms, sin180°, T _J =25°C	300	A
I ² t	I ² t Value	t _p =10ms, sin180°, T _J =25°C	450	A ² s

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V _F	Forward Voltage	I _F =25A, T _{vj} =25°C	---	1.1	---	V
I _R	Recovery Current	V _R =1600V	---	1.1	---	mA
R _{thJC}	Thermal Resistance, Junction to Case	Per Diode	---	---	1.1	K/W
T _{VJ OP}	Virtual Junction Temperature	Under Switching	-40	---	125	°C

IGBT – Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{CES}	Collector-Emitter Voltage	$T_{vj}=25^{\circ}\text{C}$	1200	V
V_{GES}	Gate-Emitter Peak Voltage	$T_{vj}=25^{\circ}\text{C}$	± 20	V
I_C	Continuous DC Collector Current	$T_C=100^{\circ}\text{C}$	15	A
I_{CRM}	Repetitive Peak Collector Current	$t_p=1\text{ms}$	30	A
P_{tot}	Total Power Dissipation	$T_C=25^{\circ}\text{C}, T_{vj\max}=150^{\circ}\text{C}$	108.7	W

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}, I_C=15\text{A}, T_{vj}=25^{\circ}\text{C}$	---	1.85	2.5	V
		$V_{GE}=15\text{V}, I_C=15\text{A}, T_{vj}=125^{\circ}\text{C}$	---	2.0	2.7	V
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=5.0\text{mA}$	5.2	6.0	6.5	V
I_{CES}	Collector-Emitter Cut-Off Current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	---	---	1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=15\text{V}, V_{CE}=0\text{V}$	---	---	410	nA
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600\text{V}$ $V_{GE}=\pm 15\text{V}$ $I_C=15\text{A}$ $R_G=35\Omega$ Inductive Load $T_{vj}=25^{\circ}\text{C}$	---	94	---	ns
t_r	Turn-on Rise Time		---	52	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	243	---	ns
t_f	Turn-off Fall Time		---	190	---	ns
E_{on}	Turn-on Switching Loss		---	1.95	---	mJ
E_{off}	Turn-off Switching Loss		---	0.81	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per IGBT	---	---	1.15	K/W
T_{VJOP}	Virtual Junction Temperature	Under Switching	-40	---	150	$^{\circ}\text{C}$

Diode - Brake

Maximum Rated Values

Symbol	Description	Conditions	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	$T_{vj}=25^{\circ}C$	1200	V
I_F	Continuous DC Forward Current	$T_C=100^{\circ}C$	15	A
I_{FRM}	Repetitive Peak Collector Current	$t_p=1ms$	30	A

Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	$I_F=15A, V_{GE}=0V, T_{vj}=25^{\circ}C$	---	1.9	2.5	V
		$I_F=15A, V_{GE}=0V, T_{vj}=125^{\circ}C$	---	1.9	2.5	V
t_{rr}	Peak Reverse Recovery Current	$I_F=15A, -di/dt=300A/us$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	---	220	---	ns
Q_r	Recovered Charge		---	0.8	---	μC
E_{rec}	Reverse Recovery Energy		---	0.2	---	mJ
R_{thJC}	Thermal Resistance, Junction to Case	Per Diode	---	---	1.45	K/W
T_{VJOP}	Virtual Junction Temperature	Under Switching	-40	---	125	$^{\circ}C$

NTC-Thermistor

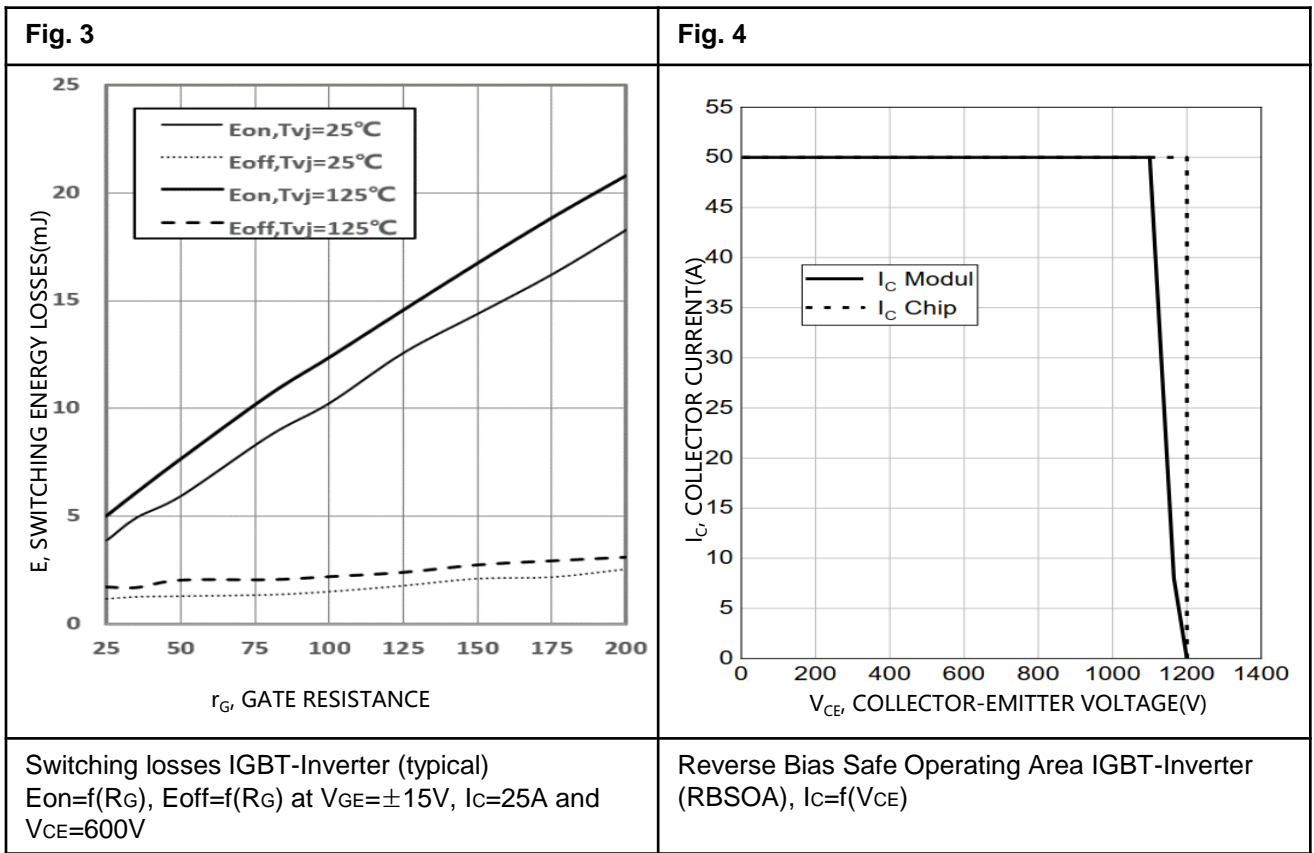
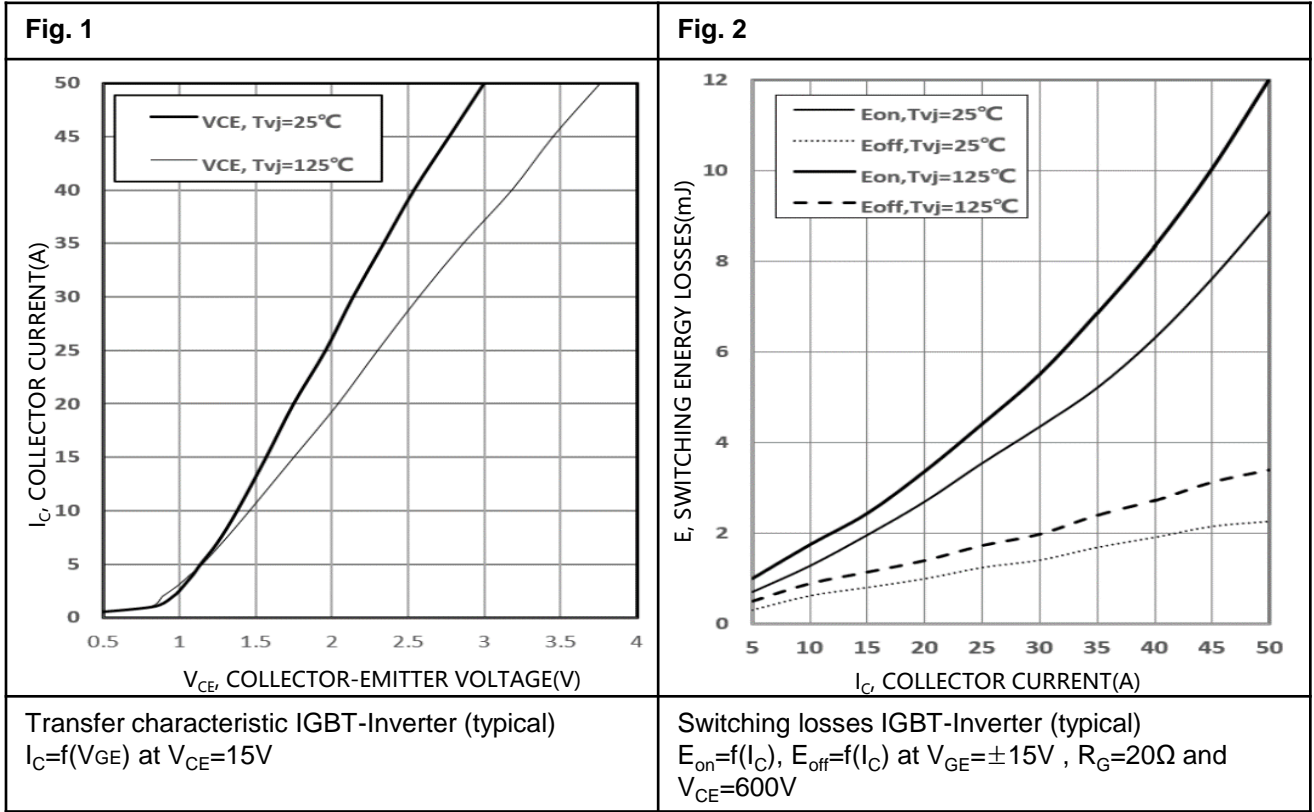
Characteristic Values

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
R_{25}	Rated Resistance	$T_C=25^{\circ}C$	---	5	---	K Ω
$B_{25/50}$	B Value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 K))]$	---	3380	---	K

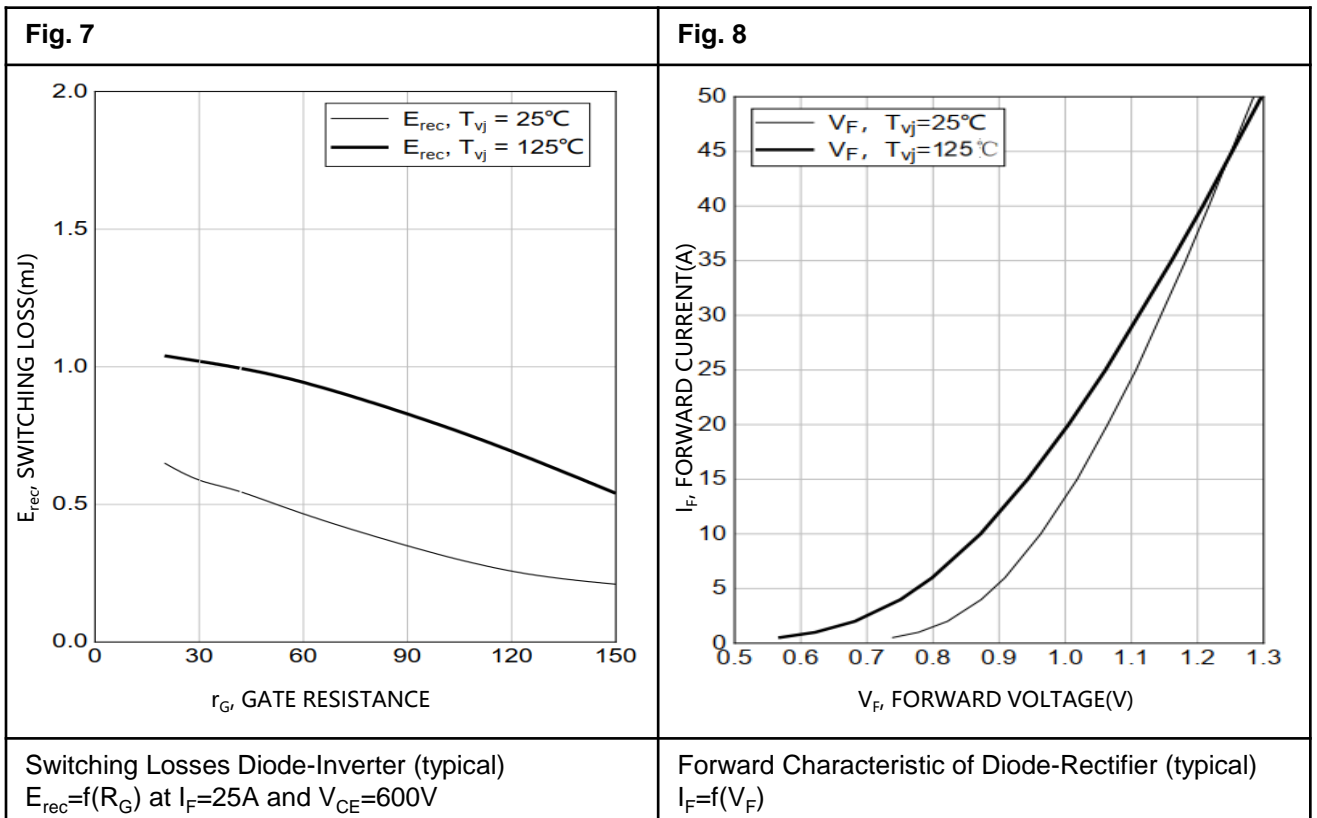
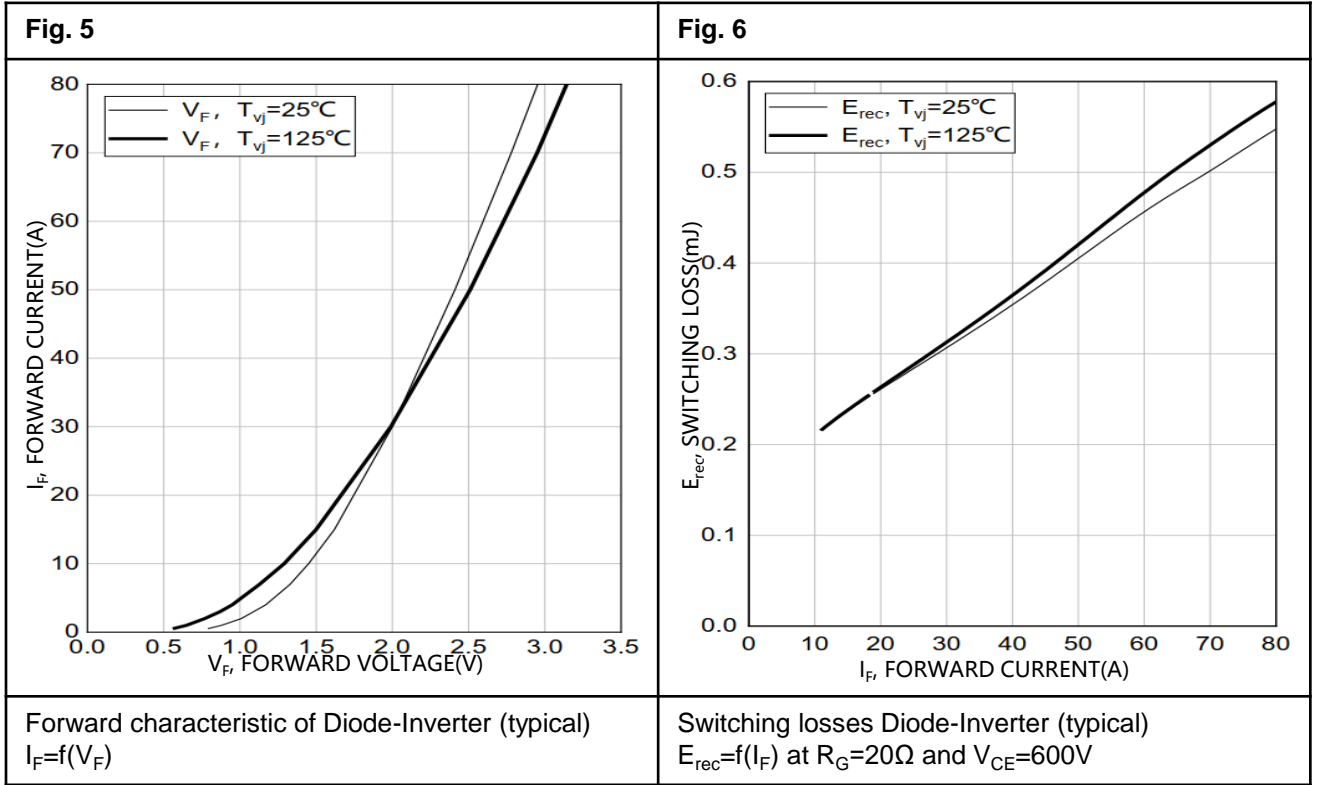
Module

Symbol	Description	Conditions	Values			Unit
			Min.	Typ.	Max.	
V _{ISOL}	Isolation Test Voltage	RMS, f=50Hz, t=1min	2500	---	---	V
T _{stg}	Storage Temperature		-40	---	150	°C
F	Mounting Force per Clamp		3	---	6	Nm
G	Weight		---	180	---	g

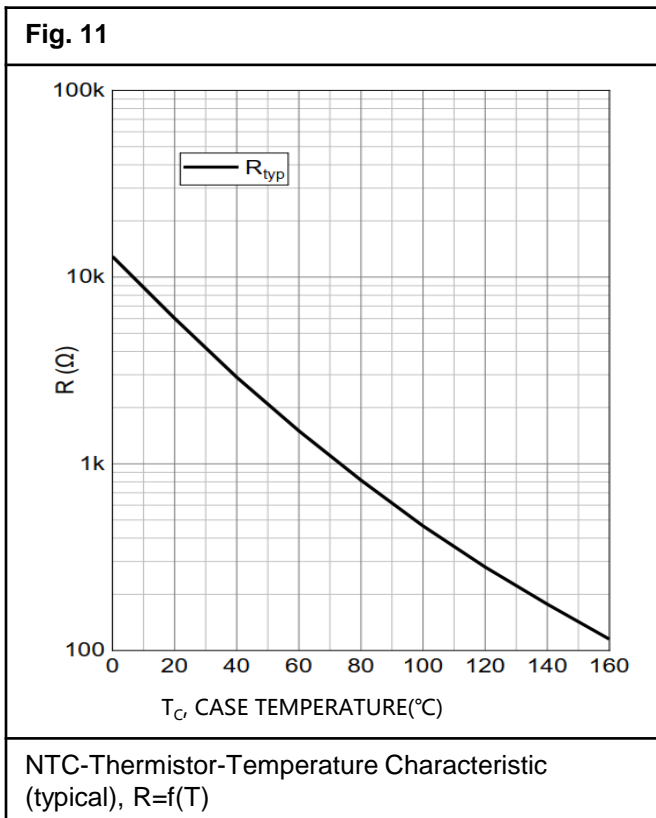
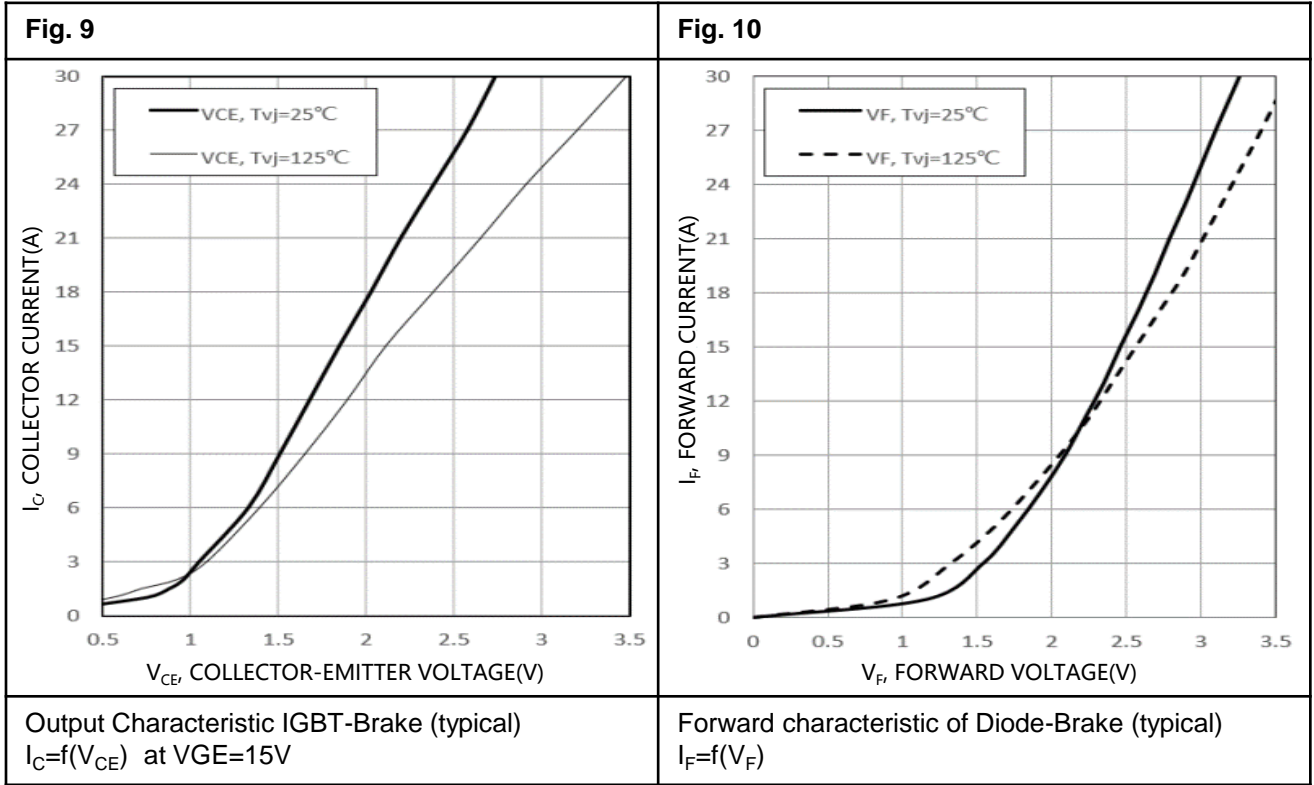
Typical Characteristics



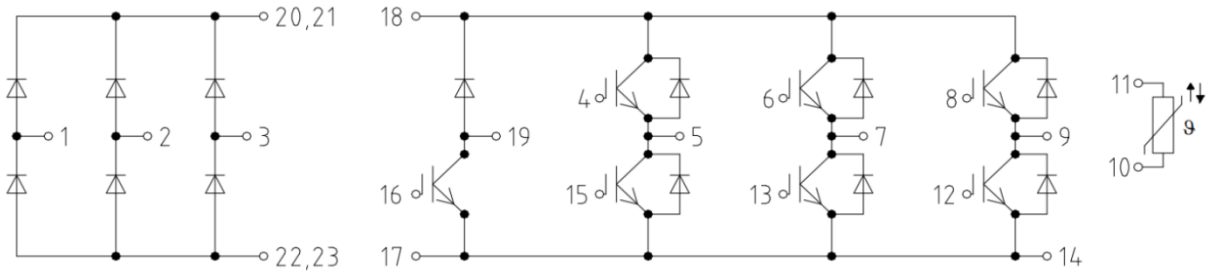
Typical Characteristics



Typical Characteristics



Circuit Diagram



Package Outlines (mm)

