STARPOWER

SEMICONDUCTOR™

IGBT

GD25PIK120C5S

Molding Type Module

1200V/25A PIM in one-package

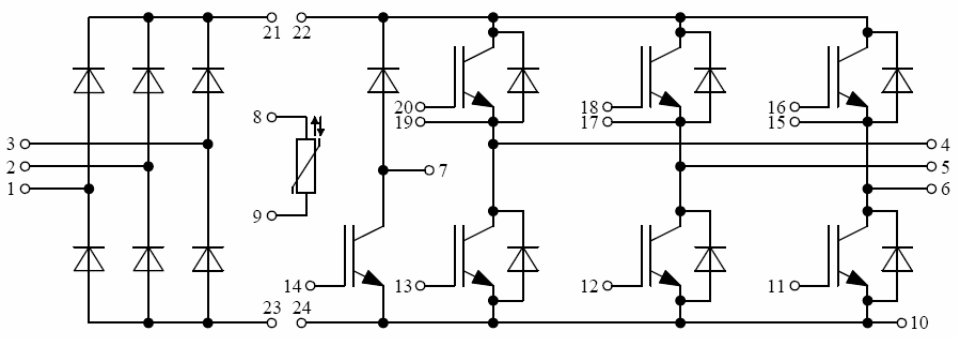
General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters.

Features

- 10μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Square RBSOA
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology

Equivalent Circuit Schematic



Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

IGBT-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD25PIK120C5S	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	1200	V
V_{GES}	Gate-Emitter Voltage	±20V	V
I_C	Collector Current @ T_C=25℃ @ T_C=80℃	40 25	A
I_{CM}	Pulsed Collector Current @ T_C=80℃	50	A
P_{tot}	Total Power Dissipation @ T_j=150℃	208	W
T_{SC}	Short Circuit Withstand Time @ T_j=150℃	10	μs

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{CES}	Collector-Emitter Breakdown Voltage	T_j=25℃	1200			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=250μA,V_{CE}=V_{GE}, T_j=25℃	4.0	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=25A,V_{GE}=15V, T_j=25℃		2.35	2.50	V
		I_C=25A,V_{GE}=15V, T_j=125℃		2.75		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=25A, R_G=10Ω, V_{GE} =±15V, T_j=25℃		2220	4260	μJ
E_{off}	Turn-Off Switching Loss			1850	3100	μJ
E_{tot}	Total Switching Loss			4070	7360	μJ
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=25A, R_G=10Ω, V_{GE} =±15V, T_j=125℃		3150	5120	μJ
E_{off}	Turn-Off Switching Loss			2720	4260	μJ
E_{tot}	Total Switching Loss			5870	9380	μJ

$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=25A, R_G=10Ω, V_{GE} =±15V, T_j=125℃		60	80	ns
t_r	Rise Time			30	45	ns
$t_{d(off)}$	Turn-Off Delay Time			450	850	ns
t_f	Fall Time			200	320	ns
C_{ies}	Input Capacitance	V_{CE} =30V, f=1Mhz, V_{GE} =0V		2370		pF
C_{oes}	Output Capacitance			455		pF
C_{res}	Reverse Transfer Capacitance			60		pF
I_{SC}	SC Data	T_P≤10μs, V_{GE}=15V, T_j=125℃, V_{CC}=900V, V_{CEM}≤1200V		100		A

DIODE-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD25PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ T_j=25℃	1200	V
I_F	DC Forward Current @ T_C=25℃ @ T_C=80℃	40 25	A
I_{FRM}	Repetitive Peak Forward Current V_R=0V,t_p=10ms,T_C=80℃	50	A
I^2t	I^2t-value,V_R=0V, t_p=10ms, T_j=125℃	170	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=25A,V_{GE}=0V	T_j=25℃		1.9	2.4	V
			T_j=125℃		2.0		
Q_r	Diode Reverse Recovered charge	I_F=25A, V_R=600V, di/dt=-700A/μs, V_{GE}=-15V	T_j=25℃		2.80		μC
			T_j=125℃		5.00		
I_{RM}	Diode Peak Reverse Recovery Current		T_j=25℃		26.0		A
			T_j=125℃		24.0		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.90		mJ
			T_j=125℃		1.80		

DIODE-rectifier T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD25PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ T_j=25℃	1700	V
$I_{F(AV)}$	DC Forward Current @ T_C=80℃	25	A
$I_{F\ RMSM}$	Forward Current RMS Maximum Per Diode @ T_C=80℃	50	A
I_{FSM}	Surge Forward Current V_R=0V, t_p=10ms,T_j=150℃	270	A
I^2t	I^2t-value,V_R=0V, t_p=10ms, T_j=150℃	360	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=25A,T_j=150℃		1.25		V
I_R	Reverse Current	T_j=125℃,V_R=1700V			2.0	mA

IGBT-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD25PIK120C5S	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	1200	V
V_{GES}	Gate-Emitter Voltage	±20V	V
I_C	Collector Current @ T_C=25℃ @ T_C=80℃	25 15	A
I_{CM}	Pulsed Collector Current @ T_C=80℃	30	A
P_{tot}	Total Power Dissipation @ T_j=150℃	140	W
T_{SC}	Short Circuit Withstand Time @ T_j=150℃	10	μs

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{CES}	Collector-Emitter Breakdown Voltage	T_j=25℃	1200			V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25℃			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25℃			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=250μA,V_{CE}=V_{GE}, T_j=25℃	4.0	5.0	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=15A,V_{GE}=15V, T_j=25℃		2.51	2.88	V
		I_C=15A,V_{GE}=15V, T_j=125℃		2.96	3.14	

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=15A, R_G=22Ω, V_{GE} =±15V, T_j=25℃		1100	1650	μJ
E_{off}	Turn-Off Switching Loss			670	1000	μJ
E_{tot}	Total Switching Loss			1770	2660	μJ
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=15A, R_G=22Ω, V_{GE} =±15V, T_j=125℃		1400	2100	μJ
E_{off}	Turn-Off Switching Loss			1100	1650	μJ
E_{tot}	Total Switching Loss			2500	3750	μJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=15A, R_G=22Ω, V_{GE} =±15V, T_j=125℃		125	190	ns
t_r	Rise Time			24	36	ns
$t_{d(off)}$	Turn-Off Delay Time			150	225	ns
t_f	Fall Time			241	360	ns
C_{ies}	Input Capacitance	V_{CE} =30V, f=1Mhz, V_{GE} =0V		1320		pF
C_{oes}	Output Capacitance			280		pF
C_{res}	Reverse Transfer Capacitance			35		pF
I_{SC}	SC Data	T_P≤10μs, V_{GE}=15V, T_j=125℃, V_{CC}=900V, V_{CEM}≤1200V		60		A

DIODE-brake-chopper T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD25PIK120C5S	Units
V_{RRM}	Collector-Emitter Voltage @ T_j=25℃	1200	V
I_F	DC Forward Current @ T_C=25℃ @ T_C=80℃	25 15	A
I_{FRM}	Repetitive Peak Forward Current V_R=0V,t_p=10ms,T_C=80℃	30	A
I^2t	I^2t-value,V_R=0V, t_p=10ms, T_j=125℃	60	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=15A,V_{GE}=0V	T_j=25℃		2.04	2.72	V
			T_j=125℃		2.16	2.74	
Q_r	Diode Reverse Recovered charge	I_F=15A, V_R=600V, di/dt=-400A/μs, V_{GE}=-15V	T_j=25℃		1.80		μC
			T_j=125℃		3.00		
I_{RM}	Diode Peak Reverse Recovery Current		T_j=25℃		16.0		A
			T_j=125℃		15.0		
E_{rec}	Reverse Recovery Energy		T_j=25℃		0.55		mJ
			T_j=125℃		1.10		

Electrical Characteristics of NTC T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	R_{100}=439Ω	5		5	%
P_{25}	Power dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, f=50Hz, t=1min		2500		V
L_{CE}	Stray inductance		60		nH
$R_{CC'+EE'}$	Module lead resistance, terminal to chip @ T_C=25℃		4.00		mΩ
$R_{\theta JC}$	Junction-to-Case (per IGBT-inverter) Junction-to-Case (per DIODE-inverter) Junction-to-Case (per DIODE-rectifier) Junction-to-Case (per IGBT-brake-chopper) Junction-to-Case (per IGBT-brake-chopper)			0.60 0.89 0.98 0.95 1.51	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.02		K/W
T_j	Operating Junction Temperature	-40		150	℃
T_{STG}	Storage Temperature Range	-40		125	℃
Mounting Torque	Power Terminal Screw:M5	2.5		5.0	N.m
	Mounting Screw:M6	3.0		6.0	N.m
G	Weight of Module		180		g

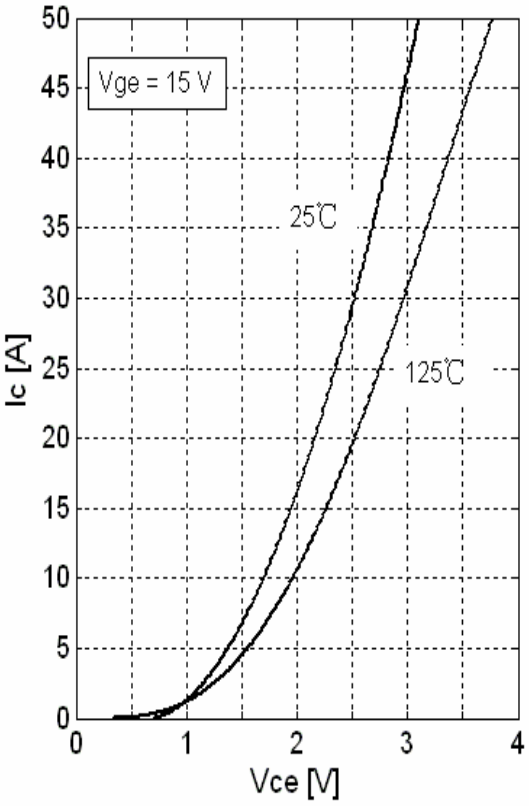


Fig 1. Typical IGBT-inverter Output Characteristics

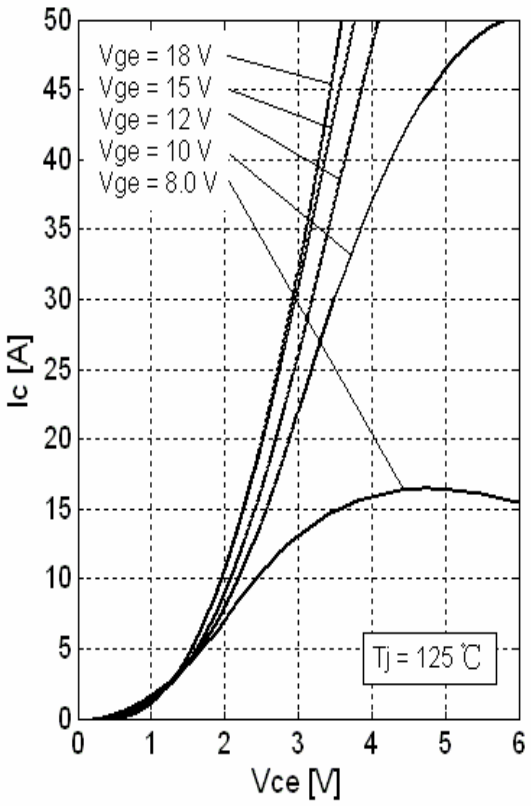


Fig 2. Typical IGBT-inverter Output Characteristics

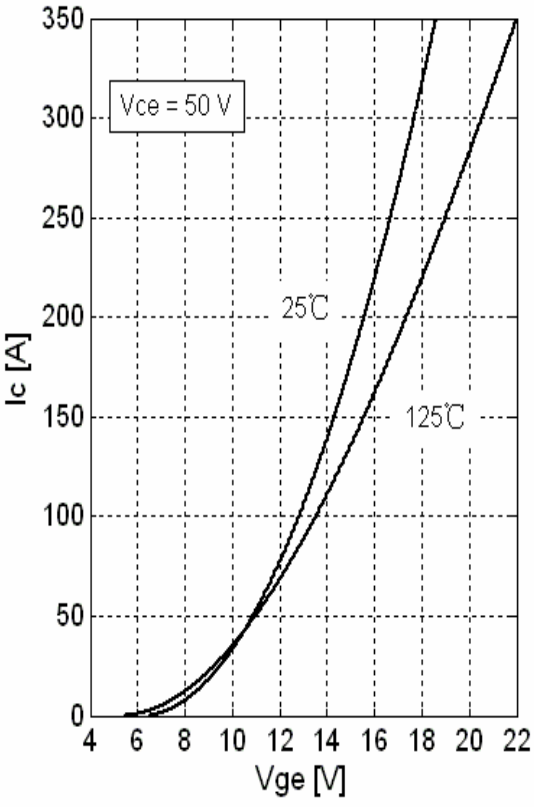


Fig 3. Typical IGBT-inverter Transfer Characteristics

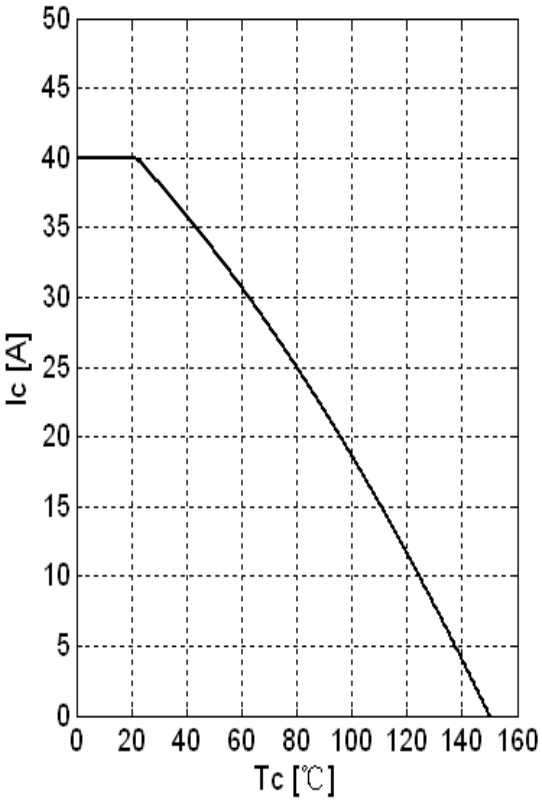


Fig 4. IGBT-inverter Maximum DC Collector vs.Case Temperature

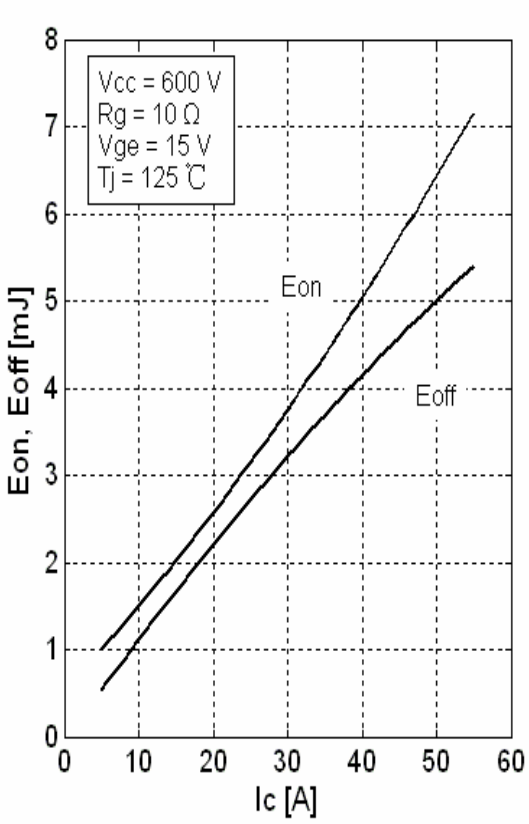


Fig 5. IGBT-inverter Switching Loss vs. Collector Current

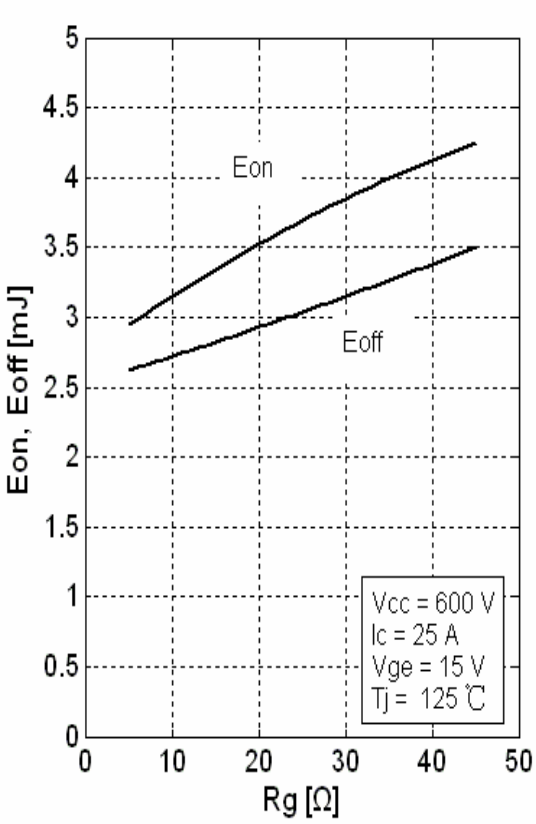


Fig 6. IGBT-inverter Switching Loss vs. Gate Resistor

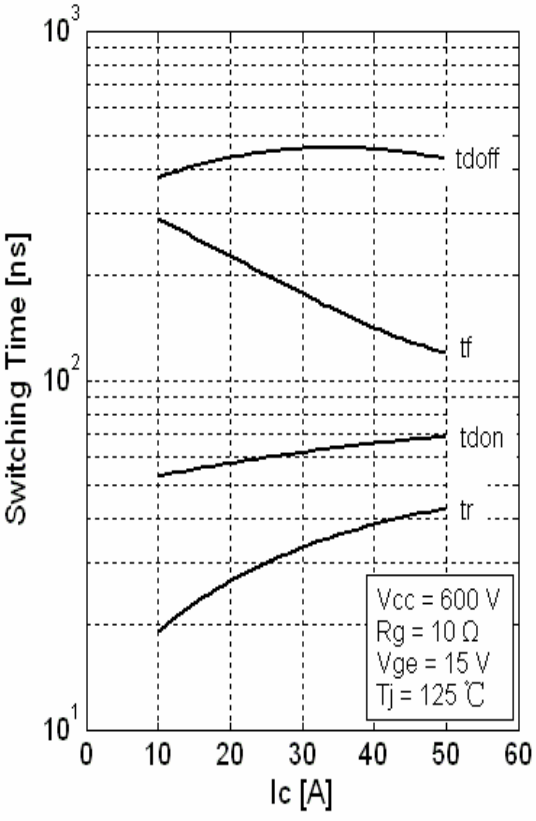


Fig 7. Typical IGBT-inverter Switching Times vs. I_C

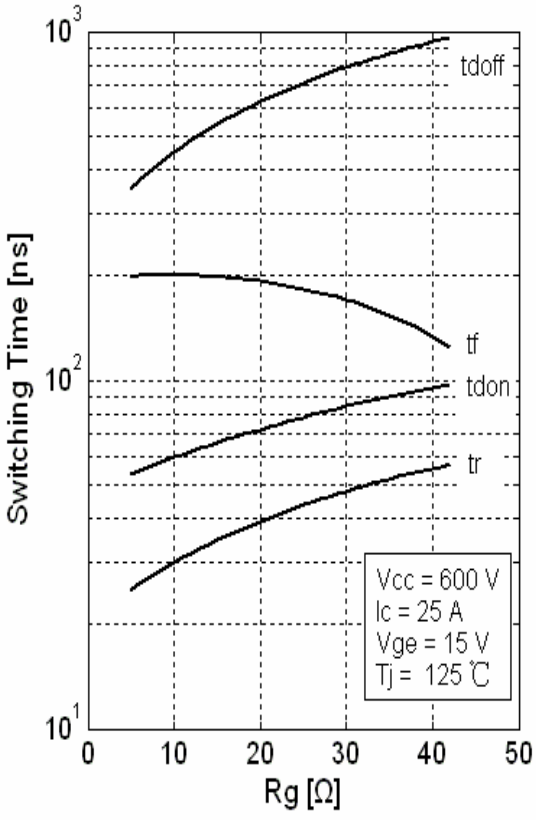


Fig 8. Typical IGBT-inverter Switching Times vs. Gate Resistance R_G

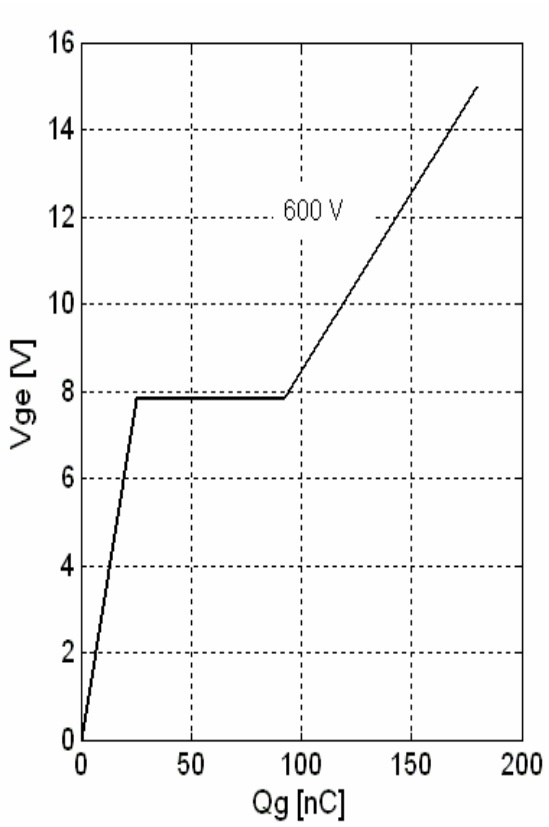


Fig 9. IGBT-inverter Gate Charge Characteristics

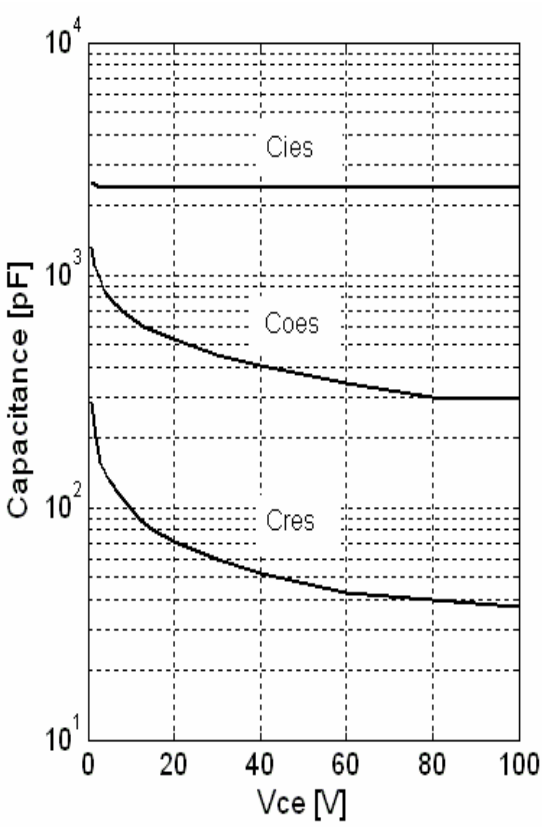


Fig 10. Typical IGBT-inverter Capacitance vs. V_{CE}

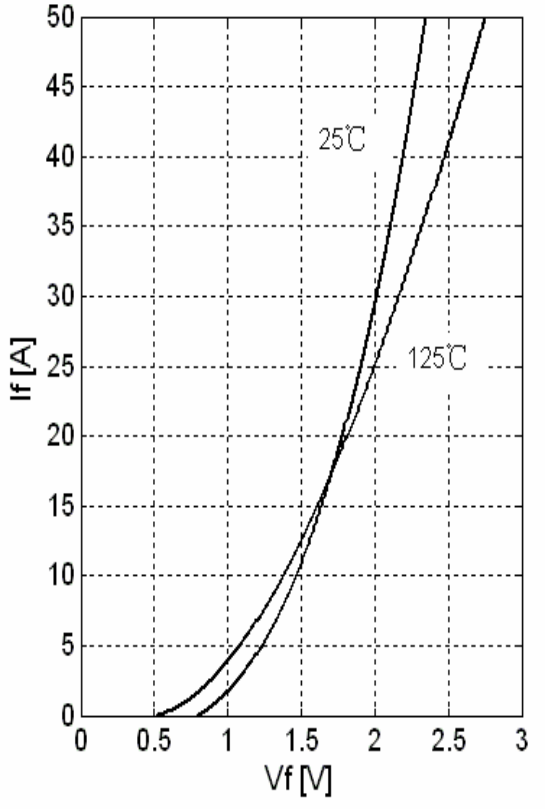


Fig 11. Typical DIODE-inverter Forward Characteristics

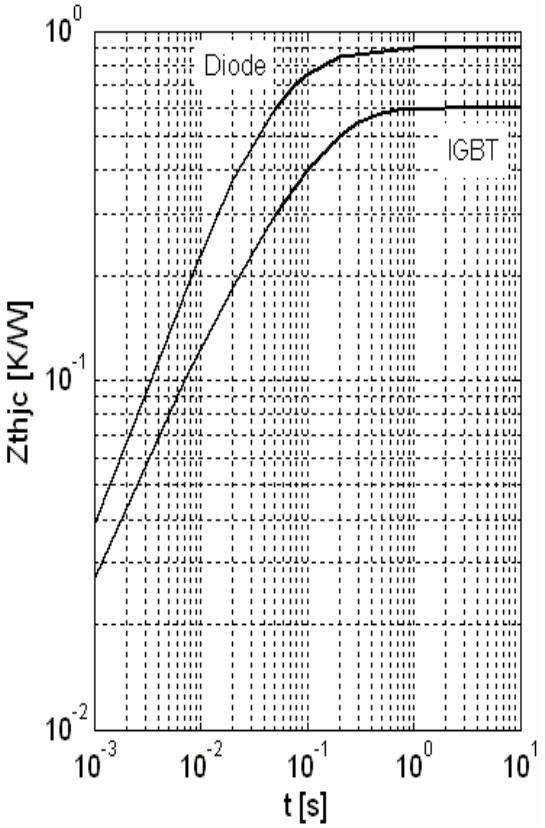


Fig 12. Transient thermal impedance (inverter)

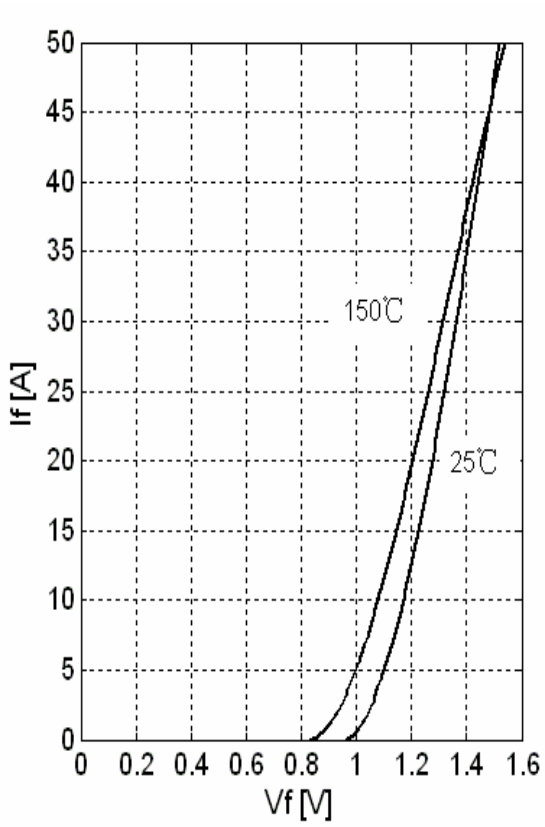


Fig 13. Typical DIODE-rectifier Forward Characteristics

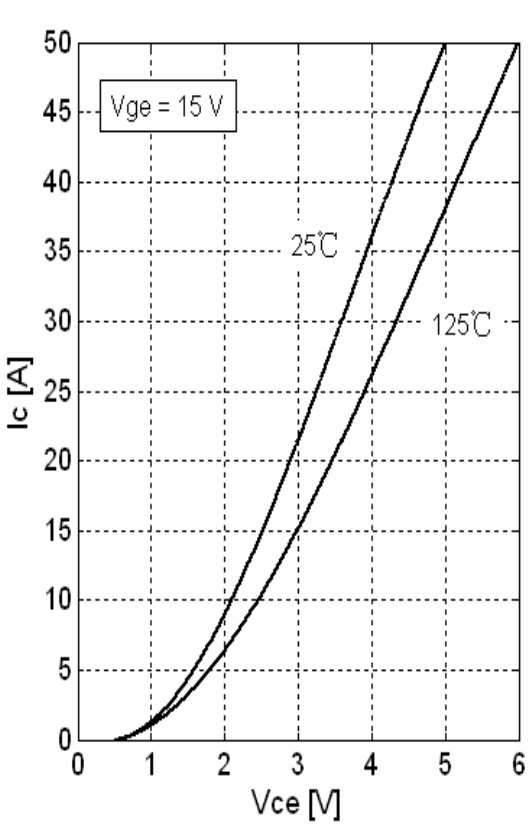


Fig 14. Typical IGBT-brake-chopper Output Characteristics

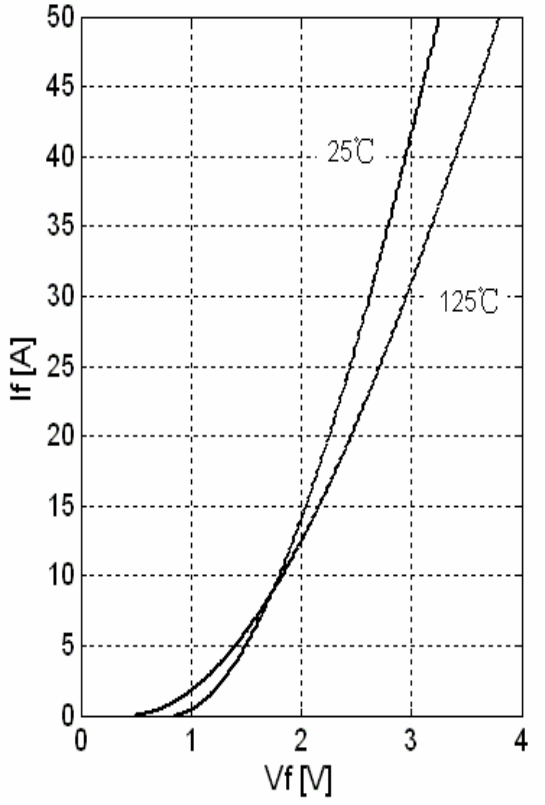


Fig 15. Typical DIODE-brake-chopper Forward Characteristics

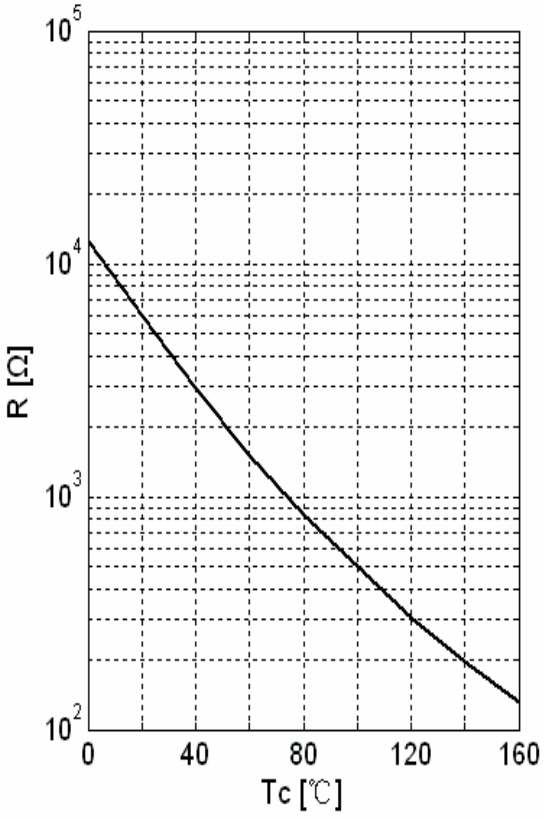
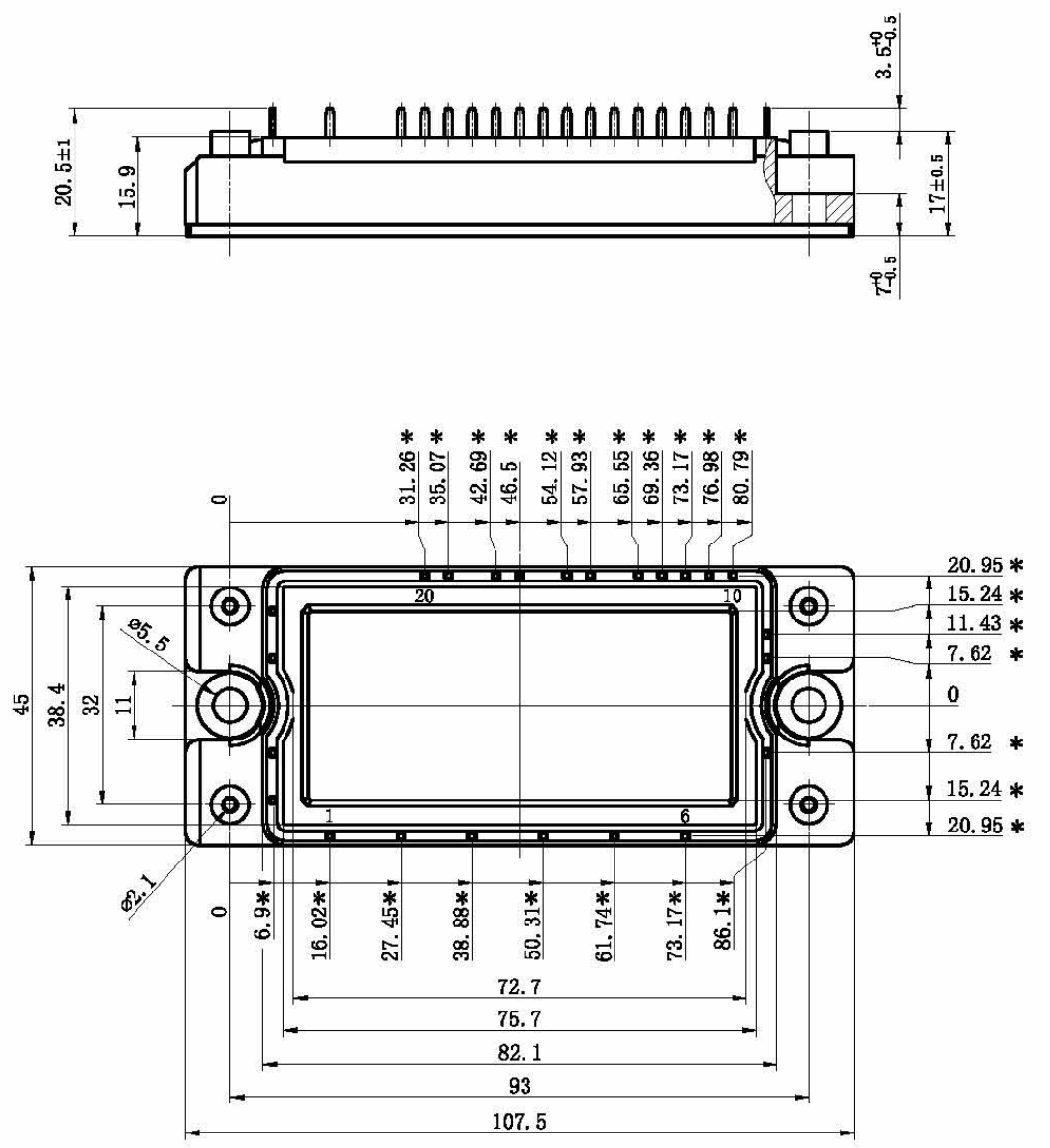


Fig 16. Typical NTC-temperature characteristic

Package Dimension

Dimensions in Millimeters



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