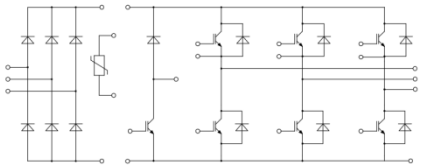
1200V, 40A, IGBT Module

General Description:

Using NCE's proprietary trench design and advanced FS (Field Stop) generation technology, the 1200V IGBT Module offers superior conduction and switching performances, and easy parallel operation.



Schematic diagram

Electrical Features

- Trench FS Technology Offering
- Very low $V_{CE(sat)}$
- High speed switching
- Positive temperature coefficient in $V_{CE(sat)}$
- Very tight parameter distribution
- High ruggedness, temperature stable behavior

Mechanical Features

- Isolated Base Plate
- Al_2O_3 Basic Insulation

Typical Applications

- Inverters
- Motor drives
- Converter

Absolute Maximum Ratings (T_C=25°C unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate- Emitter Voltage	±20	V
I_C	Collector Current @T_C = 25 °C	80	A
	Collector Current @T_C = 100 °C	40	A
I_{CRM}	Peak Collector Current@ tp=1ms	80	A
P_D	Power Dissipation @T_C = 25°C	468	W

IGBT-Inverter Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions		Value			Units
				Min.	Typ.	Max.	
Static Characteristics							
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=1mA		1200	--	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE} =0V,V_{CE}=1200V		--	--	1.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE}=+20V,V_{CE}=0V		--	--	400	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	V_{GE}=-20V,V_{CE} =0V		--	--	400	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A V_{GE}=15V	Tj=25°C	--	1.55	1.8	V
			Tj=150°C	--	1.8	--	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA,V_{CE}=V_{GE}		5.0	--	6.5	V
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	V_{GE}=15V,V_{CC}≤600V, t_{SC}≤10us,Tj≤150°C		--	240	--	A
Dynamic Characteristics							
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V, f=1MHz		--	5590	--	pF
C_{oes}	Output Capacitance			--	177	--	
C_{res}	Reverse Transfer Capacitance			--	134	--	
Q_g	Total Gate Charge	V_{CC}=960V, I_C=40A, V_{GE}=15V		--	298	--	nC
Switching Characteristics							
$t_{d(ON)}$	Turn-on Delay Time	V_{CE}=600V,I_C=40A, V_{GE}=0/15V, R_g=8Ω Inductive Load		--	19	--	ns
t_r	Rise Time			--	17	--	
$t_{d(OFF)}$	Turn-Off Delay Time			--	170	--	
t_f	Fall Time			--	18	--	
E_{on}	Turn-On Switching Loss			--	2.3	--	mJ
E_{off}	Turn-Off Switching Loss			--	1.6	--	
E_{ts}	Total Switching Loss			--	3.9	--	

Diode-Inverter Characteristics (T_C= 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
V_F	Diode Forward Voltage	I_F=40A	--	2.1	2.8	V
T_{rr}	Reverse Recovery Time	I_F=40A, di/dt=500A/us	--	180	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current		--	10	--	A
Q_{rr}	Reverse Recovery Charge		--	2.4	--	uC

IGBT-Brake-Chopper Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions		Value			Units
				Min.	Typ.	Max.	
Static Characteristics							
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=1mA		1200	--	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE} =0V,V_{CE}=1200V		--	--	1.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE}=+20V,V_{CE}=0V		--	--	200	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	V_{GE}=-20V,V_{CE} =0V		--	--	200	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=25A V_{GE}=15V	Tj=25°C	--	1.55	1.8	V
			Tj=150°C	--	1.8	--	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA,V_{CE}=V_{GE}		5.0	--	6.5	V
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	V_{GE}=15V,V_{CC}≤600V, t_{SC}≤10us,Tj≤150°C		--	120	--	A
Dynamic Characteristics							
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V, f=1MHz		--	2674	--	pF
C_{oes}	Output Capacitance			--	72	--	
C_{res}	Reverse Transfer Capacitance			--	59	--	
Q_g	Total Gate Charge	V_{CC}=960V, I_C=25A, V_{GE}=15V		--	146	--	nC
Switching Characteristics							
$t_{d(ON)}$	Turn-on Delay Time	V_{CE}=600V,I_C=25A, V_{GE}=0/15V, R_g=5Ω Inductive Load		--	19	--	ns
t_r	Rise Time			--	17	--	
$t_{d(OFF)}$	Turn-Off Delay Time			--	170	--	
t_f	Fall Time			--	18	--	
E_{on}	Turn-On Switching Loss			--	1.5	--	mJ
E_{off}	Turn-Off Switching Loss			--	0.8	--	
E_{ts}	Total Switching Loss			--	2.3	--	

Diode-Brake-Chopper Characteristics (T_C= 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	I_F=25A	--	2.2	3.0	V
T_{rr}	Reverse Recovery Time	I_F=25A, di/dt=500A/us	--	190	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current		--	12	--	A
Q_{rr}	Reverse Recovery Charge		--	2.5	--	uC

Diode-Rectifier Absolute Maximum Ratings

Symbol	Parameter	Test Conditions	Value	Units
V_{RRM}	Repetitive Peak Reverse Voltage	T_J = 25 °C	1600	V
$I_{F(AV)}$	Average On-state Current 50/60Hz, sine wave	T_C = 100 °C	50	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	T_C = 100 °C	60	A
I_{FSM}	Surge Forward Current	V_R = 0, t_p =10ms, T_J = 45 °C	320	A
I^2t	I^2t-value	V_R = 0, t_p =10ms, T_J = 45 °C	510	A^2S

Diode-Rectifier Characteristics

Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	I_F=40A, T_J = 150 °C	--	1.12	--	V
I_R	Reverse Current	T_J = 25 °C, V_R=1600V,	--	--	2.0	mA

NTC-Thermistor Characteristics (T_C= 25°C unless otherwise specified)

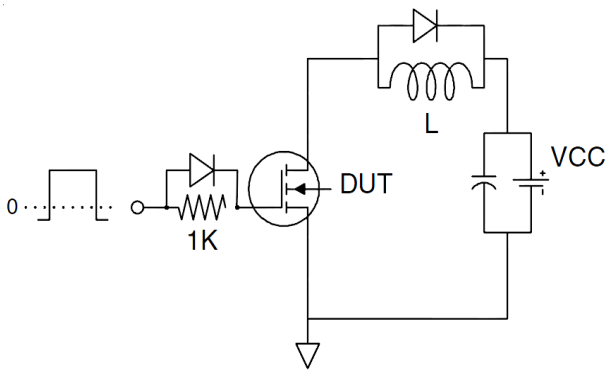
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
R_{25}	Rated Resistance		--	5.0	--	KΩ
ΔR/R	Deviation of R100	T_C=100,R_{100}=493.3Ω	-5.0	--	5.0	%
P_{25}	Power Dissipation		--	20	--	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	--	3375	--	K

Module Characteristics (T_C=25°C unless otherwise noted)

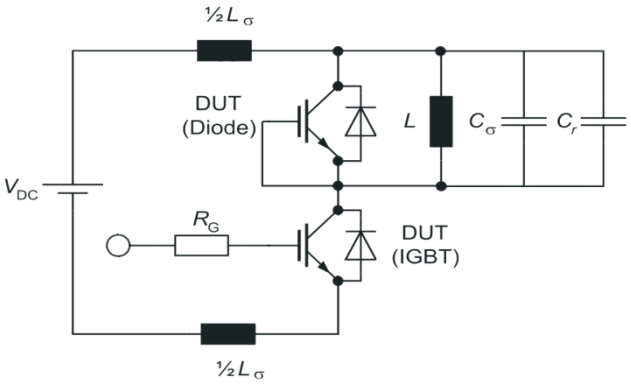
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{isol}	Isolation Voltage	f=50Hz, t=1min	2500	--	--	V
	Material of Module Baseplate			Cu		
T_{jmax}	Maximum Junction Temperature		--	--	175	°C
$T_{vj\ op}$	Operating Junction Temperature		-40	--	150	°C
T_{stg}	Storage Temperature		-40	--	125	°C
L_{SCE}	Stray-inductance-module		--	60	--	nH
$R_{CC'+EE'}$	Module lead resistance	T_C=25°C, per switch	--	4.0	--	mΩ
$R_{\theta JC}$	Junction to case	per IGBT-Inverter	--	0.32	--	K/W
$R_{\theta JC}$	Junction to case	per Diode-Inverter	--	0.61	--	K/W
$R_{\theta JC}$	Junction	per IGBT-Brake-Chopper	--	0.41	--	K/W
$R_{\theta JC}$	Junction	per Diode-Brake-Chopper	--	0.78	--	K/W
$R_{\theta JC}$	Junction	per Diode-Rectifier	--	0.75	--	K/W
$R_{\theta CH}$	Case to Sink	per Module	--	0.02	--	K/W
M_s	Module-to-Sink Torque	Recommended(M5)	3.0	--	6.0	Nm
G	Weight of Module		--	180	--	g

Test Circuit

1) Gate Charge Test Circuit

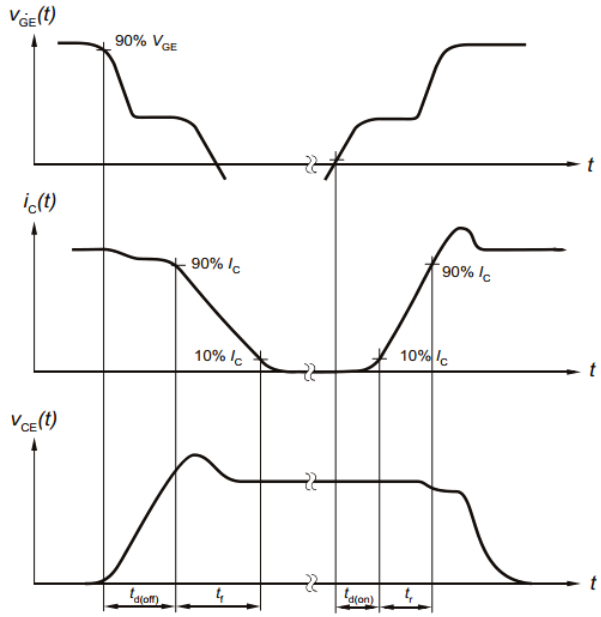


2) Switch Time Test Circuit

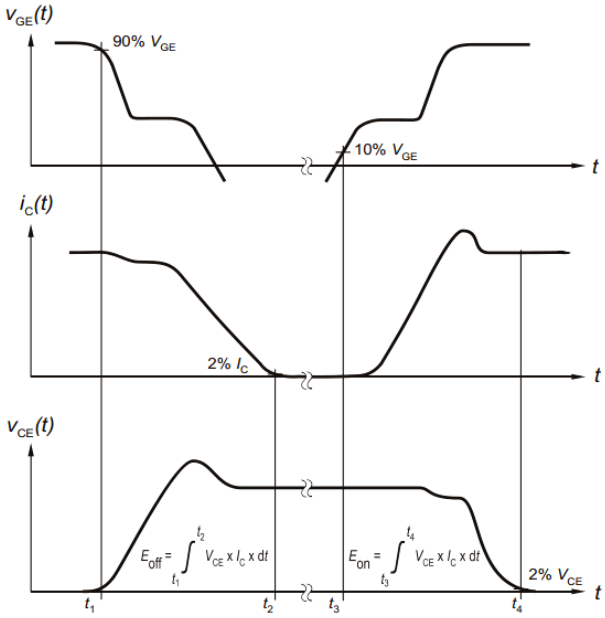


Switching characteristics

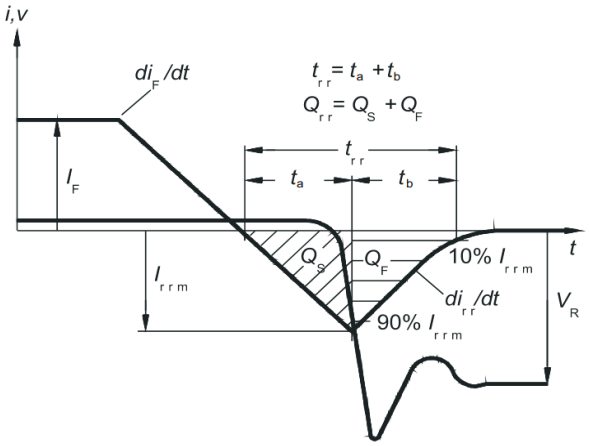
1) Definition of switching times



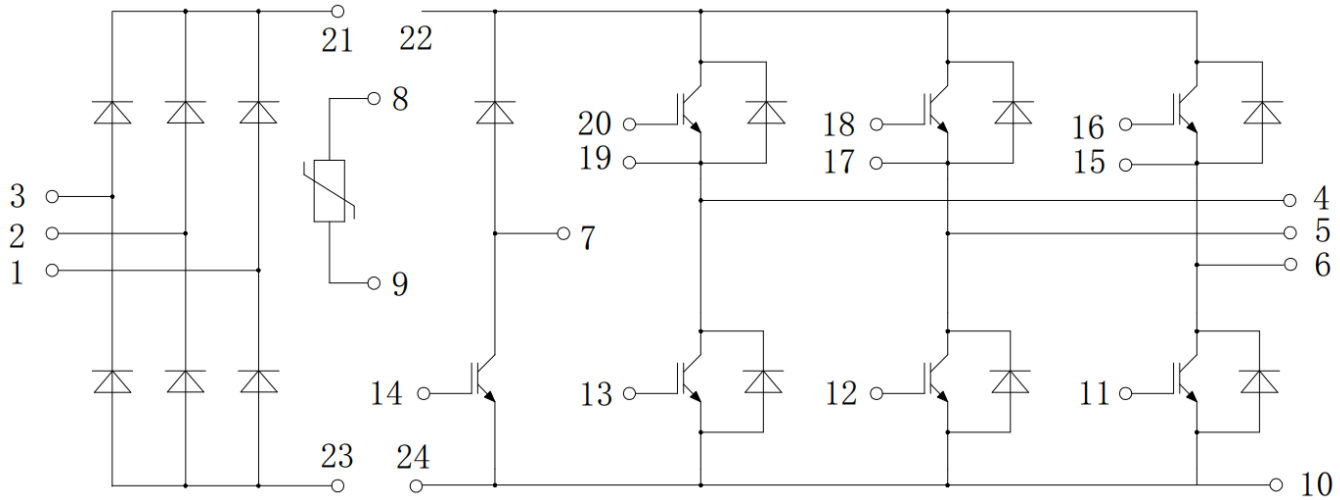
2) Definition of switching losses



3) Definition of diode switching characteristics

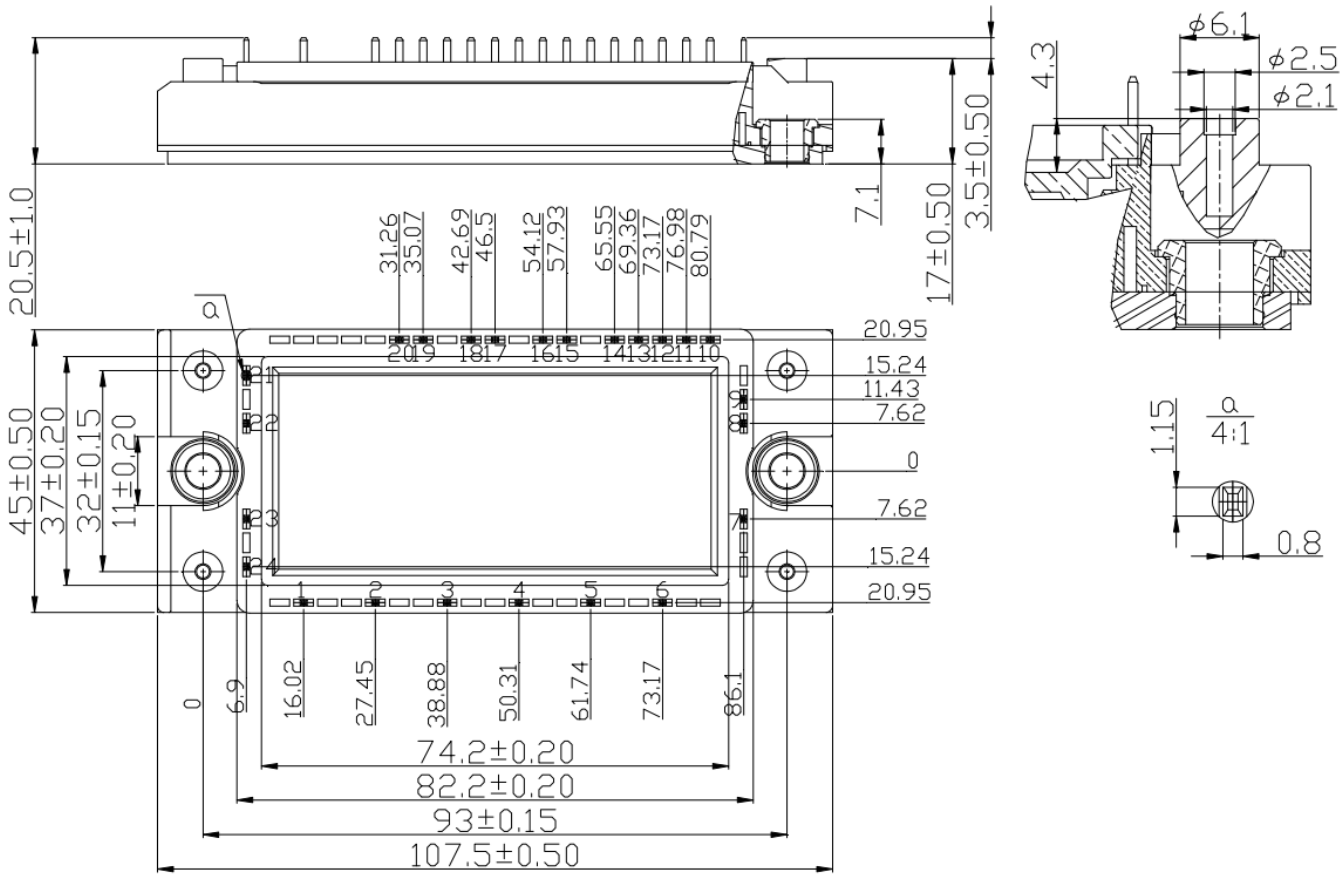


Circuit Diagram



Package Dimensions

Dimensions in Millimeters



Attention:

- Any and all NCE power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your NCE power representative nearest you before using any NCE power products described or contained herein in such applications.
- NCE power assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all NCE power products described or contained herein.
- Specifications of any and all NCE power products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- NCE power Semiconductor CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all NCE power products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of NCE power Semiconductor CO.,LTD.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. NCE power believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the NCE power product that you intend to use.
- This catalog provides information as of Sep.2010. Specifications and information herein are subject to change without notice.