MCF450N120S2E3

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V_{CE}	Ic nom
1200V	450A

E3

DESCRIPTION

The MCF450N120S2E3 module with JSCJ advanced Trench and FS (Field Stop) IGBT provide very low Collector-Emitter Saturation Voltage, easy to use in drives and inverters.

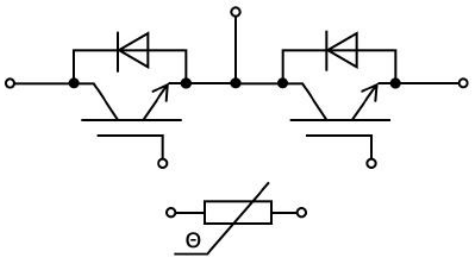
Features

- 1200V Trench Gate & Field Stop Structure
- High Short Circuit Capability
- Low switching loss
- High Reliability
- Positive Temperature Coefficient

Application

- Solar Inverter
- Uninterrupted Power Supply
- Servo Driver
- Motor Driver

EQUIVALENT CIRCUIT



Order Code	Package	Marking	Parking
MCF450N120S2E3	E3	450N120	Module

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	DC Collector Current, Tc=100℃	450	A
I_{CM}	Peak Collector Current, tp=1ms	900	A
I_F	Continuous Diode Forward Current	450	A
I_{FRM}	Diode Peak Forward Current, t_p=1ms	900	A
P_D	IGBT Maximum Power Dissipation	2080	W
t_{sc}	IGBT Short Circuit Withstand Time	10	μs
$T_{vJ\ MAX}$	Maximum Junction Temperature	175	℃
T_{vJ}	Operating Junction Temperature	-40 to 150	℃
T_{STG}	Storage Temperature	-40 to 125	℃
T_L	Maximum lead temperature for soldering	260	℃

Electrical Characteristics (TJ=25°C unless otherwise noted)

Parameter	Symbol	Condition		Value			Unit
				Min	Typ.	Max	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C=450A	T_{vj}=25℃		1.75	2.10	V
			T_{vj}=125℃		2.15		V
			T_{vj}=150℃		2.25		V
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C=17mA, V_{CE}=V_{GE}			5.9		V
Collector-Emitter Cut-off Current	I_{CES}	V_{CE}=1200V, V_{GE}=0V				5	mA
Gate-Emitter Leakage Current	I_{GES}	V_{CE}=0V, V_{GE}=±20V		-400		400	nA
Internal Gate Resistance	R_{Gint}	T_{vj}=25℃			1.50		Ω
Gate Charge	Q_G	V_{GE}=-15V~+15V			7.4		μC
Input Capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz			133.0		nF
Reverse Transfer Capacitance	C_{res}				1.5		nF
Turn-on Delay Time	$t_{d(on)}$	I_C=450A V_{CE}=600V V_{GE}=±15V R_{Gon}=1.3Ω R_{Goff}=1.3Ω L_S=25nH Inductive Load	T_{vj}=25℃		370		ns
			T_{vj}=125℃		380		ns
			T_{vj}=150℃		390		ns
Rise Time	t_r		T_{vj}=25℃		160		ns
			T_{vj}=125℃		180		ns
			T_{vj}=150℃		190		ns
Turn-off Delay Time	$t_{d(off)}$		T_{vj}=25℃		510		ns
			T_{vj}=125℃		550		ns
			T_{vj}=150℃		560		ns

Fall Time	t_f	I_C=450A V_{CE}=600V V_{GE}=±15V R_{Gon}=1.3Ω R_{Goff}=1.3Ω L_S=25nH Inductive Load	T_{vj}=25℃		90		ns
			T_{vj}=125℃		120		ns
			T_{vj}=150℃		130		ns
Turn-on Energy Loss	E_{on}		T_{vj}=25℃		52.0		mJ
			T_{vj}=125℃		72.5		mJ
			T_{vj}=150℃		75.5		mJ
Turn-off Energy Loss	E_{off}		T_{vj}=25℃		39.0		mJ
			T_{vj}=125℃		49.5		mJ
			T_{vj}=150℃		53.5		mJ
Short Circuit Current	I_{SC}	V_{GE}≤15V, t_p≤10us, V_{CC}=800V, T_{vj}=150℃ $V_{CE,max}$=V_{CES}-$L_{s,CE}$ x di/dt			1800		A

Diode Electrical Characteristics

Parameter	Symbol	Condition		Value			Unit
				Min	Typ.	Max	
Forward Voltage	V_F	I_F=450A	T_{vj}=25℃		2.25		V
			T_{vj}=125℃		2.35		V
			T_{vj}=150℃		2.35		V
Reverse Recovery Time	t_{rr}	I_F=450A, V_R=600V, V_{GE}=-15V di_F/dt=-1700A/μs (T_{vj}=150℃)	T_{vj}=25℃		230		ns
			T_{vj}=125℃		445		ns
			T_{vj}=150℃		580		ns
Reverse Recovery Current	I_{rr}		T_{vj}=25℃		120		A
			T_{vj}=125℃		155		A
			T_{vj}=150℃		180		A
Reverse Recovery Charge	Q_{rr}		T_{vj}=25℃		14.5		μC
			T_{vj}=125℃		35.5		μC
			T_{vj}=150℃		53.5		μC
Reverse Recovery Energy Loss	E_{rec}		T_{vj}=25℃		4.5		mJ
			T_{vj}=125℃		13.0		mJ
			T_{vj}=150℃		20.5		mJ

NTC-Thermistor

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Rated resistance	R_{25}	Tc=25℃		5.00		KΩ
Power dissipation	P_{25}				10	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3380		K

Package Properties

Parameter	Symbol	Condition	Value			Unit
			Min	Typ.	Max	
IGBT Thermal Resistance: Junction to Case	$R_{th(J-C)}$	per IGBT			0.0721	K/W
Diode Thermal Resistance: Junction to Case	$R_{th(J-C)}$	per Diode			0.0908	K/W
IGBT Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	per IGBT λ_{grease}=1W/(m•K)		0.038		K/W
Diode Thermal Resistance: Case to Heatsink	$R_{th(C-H)}$	per Diode λ_{grease}=1W/(m•K)		0.074		K/W
Isolation Voltage	V_{isol}	RMS, f=50Hz, t=60s	2500			V
Creepage Distance	d_{cr}	Terminal to Heatsink	14.5			mm
		Terminal to Terminal	13			mm
Clearance Distance	d_{cl}	Terminal to Heatsink	12.5			mm
		Terminal to Terminal	10			mm
Comparative Tracking Index	CTI		>200			
Module Stray Inductance	$L_{s,\ CE}$	per Switch		20		nH
Module lead Resistance, Terminal to Chip	$R_{CC`+EE`}$	per Switch, T_C=25℃		0.80		mΩ
Mounting Torques	M	Baseplate to Heatsink, M5	3		6	Nm
		Power Terminal, M6	3		6	Nm
Module Weight	G			350		g

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

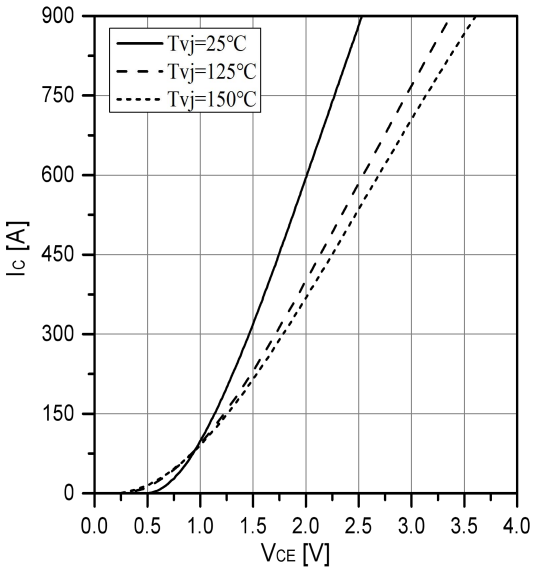


Fig.1 IGBT Output Characteristic
I_C vs V_{CE}, V_{GE}=15V

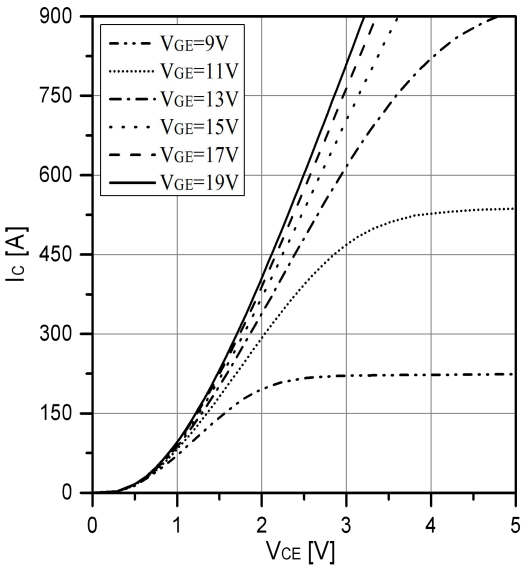


Fig.2 IGBT Output Characteristic
I_C vs V_{CE}, T_{vj}=150℃

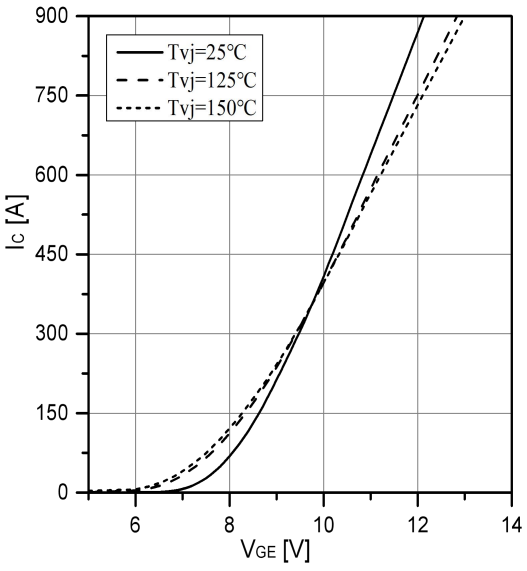


Fig.3 IGBT Transfer Characteristic
I_C vs V_{GE}, V_{CE}=20V

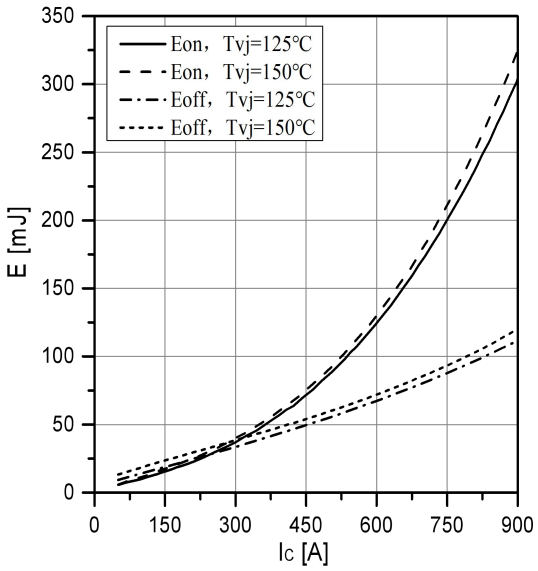


Fig.4 IGBT Switching Energy Loss
E_{on}, E_{off} vs I_C, V_{CE}=600V, V_{GE}=±15V, R_G=1.3Ω

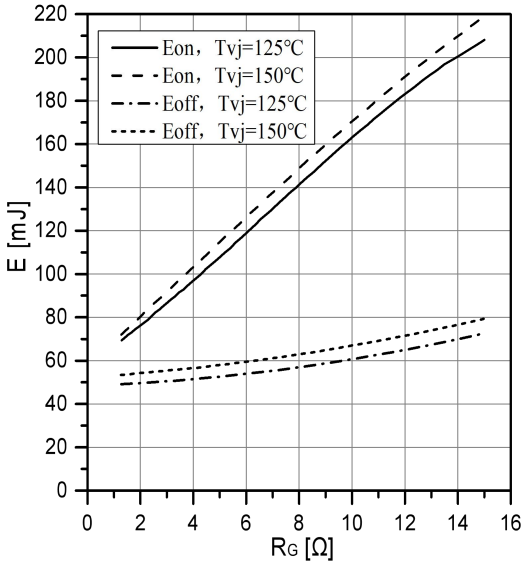


Fig.5 IGBT Switching Energy Loss
E_{on}, E_{off} vs R_G, I_C=450A, V_{CE}=600V, V_{GE}=±15V

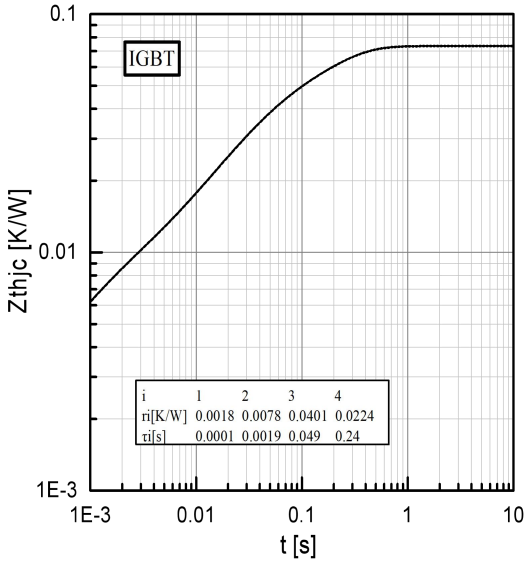


Fig.6 Transient Thermal Impedance IGBT
Z_{thJC} vs t

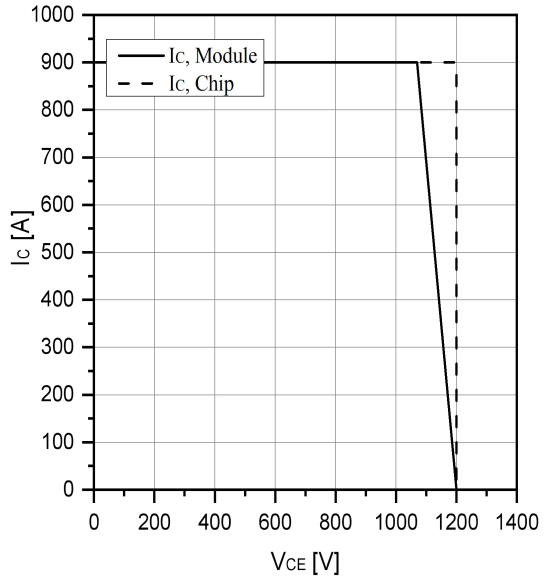


Fig.7 Reverse Bias Safe Operating Area IGBT(RBSOA)
I_C vs V_{CE}, V_{GE}=±15V, R_G=1.3Ω, Tvj=150℃

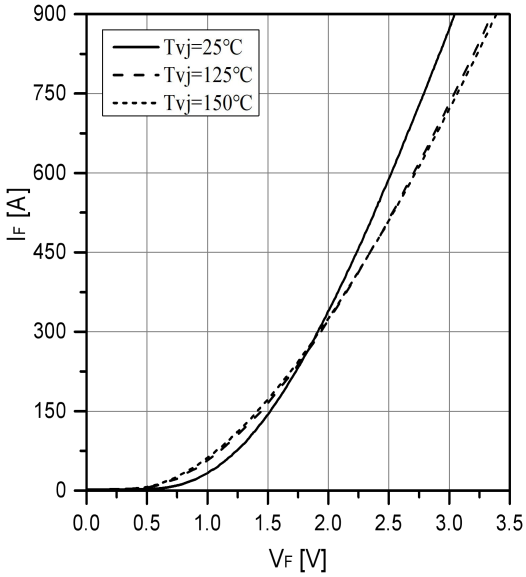


Fig.8 Diode Forward Characteristic
I_F vs V_F

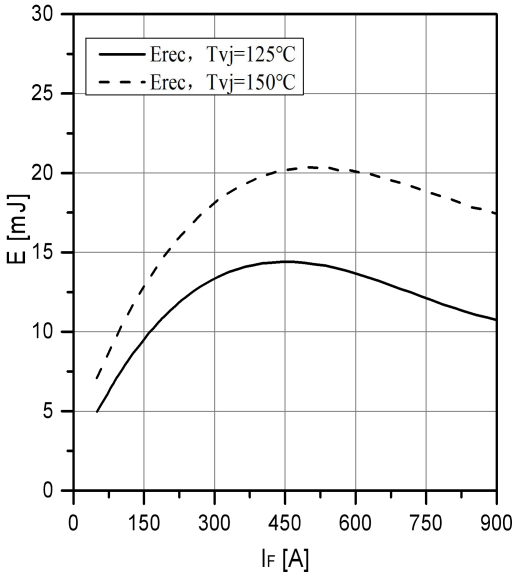


Fig.9 Diode Reverse Recovery Energy Loss
E_{rec} vs I_F, V_R=600V, R_G=1.3Ω

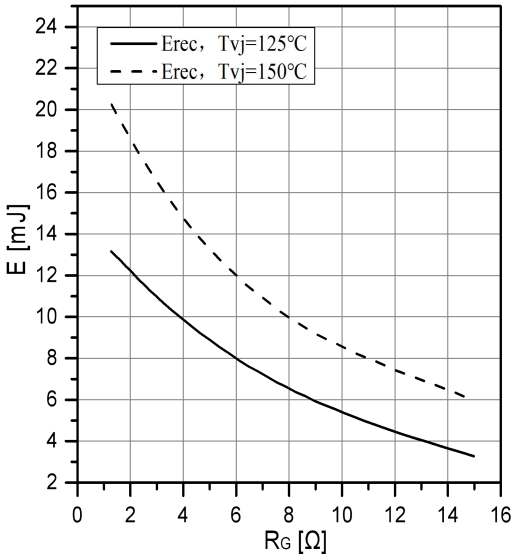


Fig.10 Diode Reverse Recovery Energy Loss
E_{rec} vs R_G, V_R=600V, I_F=450A

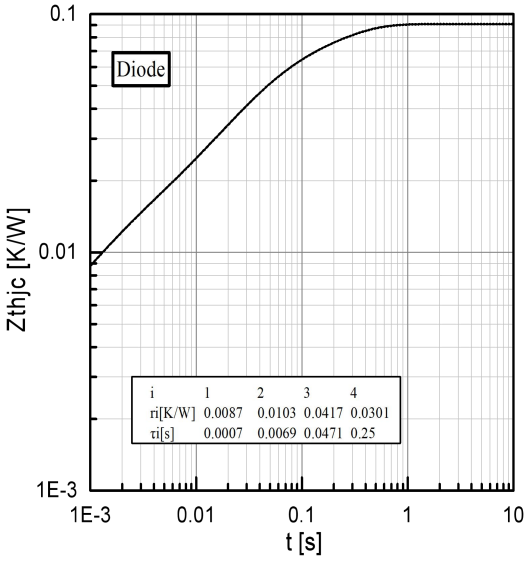


Fig.11 Transient Thermal Impedance Diode
Z_{thJC} vs t

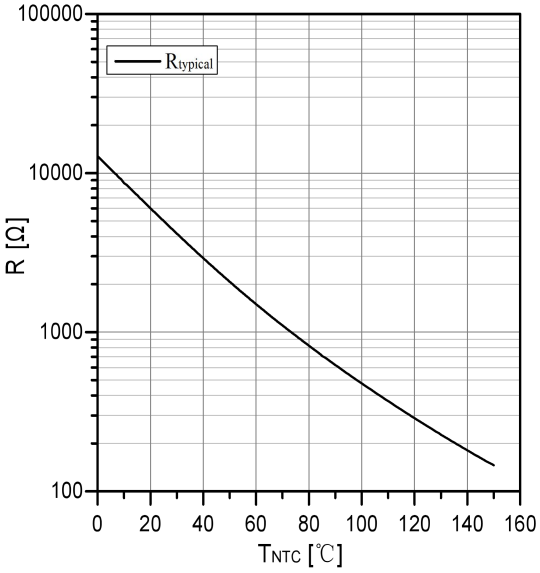
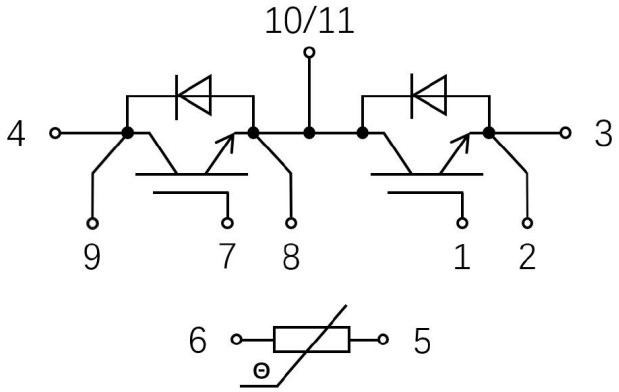


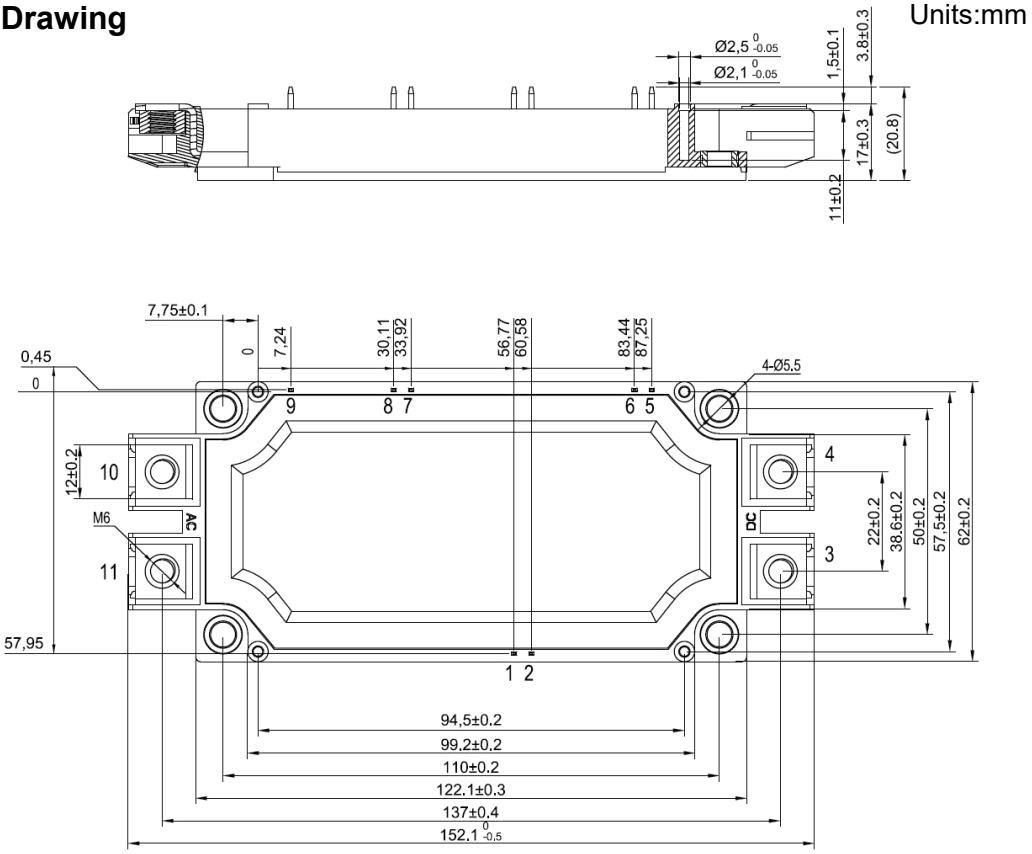
Fig.12 NTC Temperature Characteristic (typical)
R vs T

Circuit Diagram



Outline Drawing

Units:mm



Revision History

Version	Date	Description
v1.0	2022-01-22	Preliminary Version
v2.0	2022-06-16	Formal Version