Ideal Power

Technical Specifications

Bidirectional SymCool™ IQ Intelligent Power Module with Driver, 1200V/160A

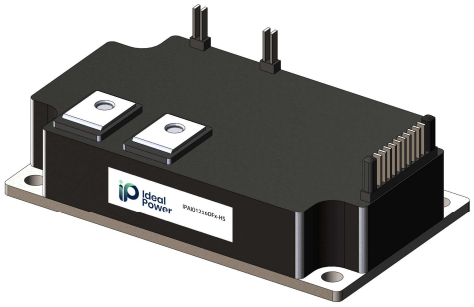
Part Number : IPAI01216D1Fx

Description:

The SymCool™ IQ is a bidirectional intelligent power module (IPM) with integrated driver which makes the system design easy and seamless. It is based on Ideal Power's innovative B-TRAN™ with ultra-low on-state voltage drop. The integrated driver provides driving power for B-TRAN™ dies and protection features such as overcurrent protection, undervoltage protection, temperature sensing and a dedicated FLT pin. Novel packaging design techniques reduces the thermal resistance of the package and enhances the power density of the module.

Key Features:

- Bidirectional Switching Operation
- Ultra-Low On-State Voltage Drop
- Low Switching Losses
- Switching Frequency: Up to 35 kHz
- Low Parasitic Inductance and Capacitance



SymCool™ IQ

Applications:

- Solid-State Circuit Breaker
- Battery Disconnect Switch
- Vienna Rectifier
- T-Type Inverter
- Matrix Converter

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1 SymCool™ IQ Top-level Block Diagram

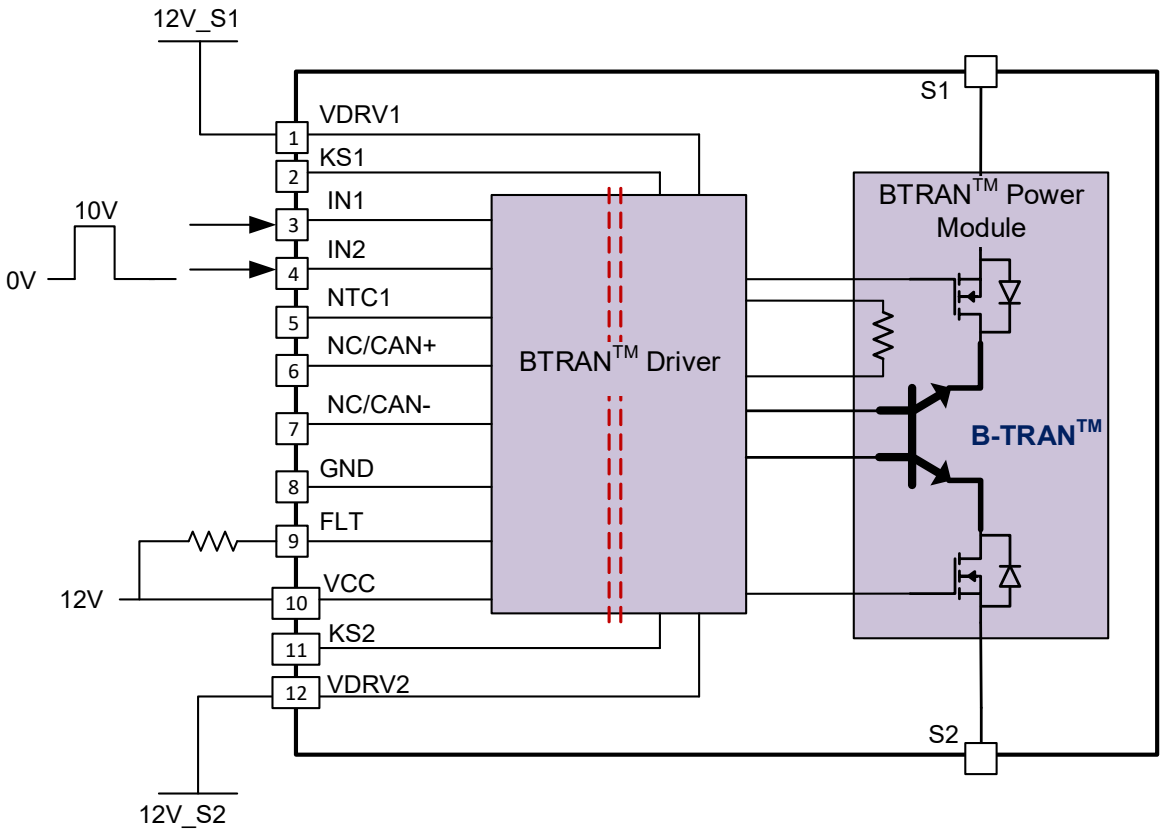

Figure 1 Pin Configuration

2 Maximum Ratings for SymCool™ IQ

2.1 Module Section

Description	Symbol	Conditions	Value	Unit
Storage temperature range	T_{STG}		-40 ~ +125	°C
Operating case temperature	T_C		-40 ~ +125	°C
Operating junction temperature	T_J		-40 ~ +150	°C
Isolated test voltage	V_{ISO}	1min, RMS, f=60Hz	2500	V

2.2 Inverter Section

Description	Symbol	Conditions	Value	Unit
Blocking voltage	V_{BR}		1200	V
DC emitter current T_c = 25°C T_c = 100°C	I_E		 240 160	 A A
Pulsed emitter current	I_{Epulse}		400	A
Emitter-Base breakdown voltage	V_{EB}		65	V
Short circuit withstand time	t_{SC}		15	µs
Power dissipation T_C = 25°C Power dissipation T_C = 100°C	P_{tot}		2000 800	W
Operating junction temperature	T_{vj}		-40 ~ +150	°C

2.3 Control Section

Description	Symbol	Conditions	Value	Unit
High side offset voltage	V_{BR}		1200	V
Drive voltage	$V_{DRV1/2}$		7 ~ 16	V
Control input voltage	$V_{IN1/2}$		0 ~ 15	V
V_{CC} input voltage	V_{CC}		15	V
NTC output voltage	V_{NTC}		5	V
Driving current on I_{DRVx}	I_{DRVx}		12.5	A

3 Thermal Characteristics (T_J = 25°C)

Description	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Single B-TRAN™ thermal resistance, junction-case	R_{thJC}	High side V-phase		0.07	-	K/W

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4 Static Characteristics (T_J = 25°C)

(T_J = 25ºC, unless otherwise stated)

4.1 Inverter Section

Description	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Emitter-Emitter saturation voltage	$V_{E1E2(on)}$	V_{B1E1} or V_{B2E2} =1.5V, I_{E1E2}=160A	---	0.6	0.8	V
Base-Emitter voltage (on-state)	V_{B1E1} or V_{B2E2}	I_{B1E1} or I_{B2E2} = 20A	1.4	1.5	1.6	V
Emitter-Base breakdown voltage (off-state)	$V_{R(B1E1)}$ or $V_{R(B2E2)}$	I_{E1B1} or I_{E2B2} = 1mA	52	65	78	V
Emitter leakage current	I_{E1B2} or I_{E2B1}	at V_{E1B2} or V_{E2B1} = 1200V	---	200	400	µA
DC current gain	h_{FE}	I_{E1E2} = 50A		7	9	
	h_{FE}	I_{E1E2} = 100A		5	7	

4.2 Control Section

Description	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Logic "1" input voltage	$V_{IN1/2}$	V_{CC}=12V	-	3	12	V
Logic "0" input voltage	$V_{IN1/2}$	V_{CC}=12V	0.7	0.9	-	V
V_{CC} voltage	V_{CC}	w.r.t GND	8	12	14	V
Supply current	I_{VCC}				100	mA
Drive undervoltage lockout	$VDRV_{UVLOF}$	VDRV Falling	7.5	8.5	9.5	V
	$VDRV_{UVLOR}$	VDRV Rising	7.2	8	8.8	V
Drive voltage	$V_{RDV1/2}$			12	16	V
Drive current	I_{DRV}	I_{EE} = 160A, V_{DRV}=12V		6		A
NTC output voltage	NTC1	T_J = 125 ºC				

5 Dynamic Characteristics (T_J = 25°C)

SymCool™ IQ Switching Characteristics-Switching Characteristics, Inductive Load (T_J = 25°C)

Description	Symbol	Conditions	Value	Unit
Turn-on delay time	$t_{d(on)}$	V_{E1E2} = 600 V, I_{E1E2} = 160 A V_{B1E1} or V_{B2E2} = 2V	20	ns
Rise time	t_r		60	ns
Turn-off delay time	$t_{d(off)}$		100	ns
Fall time	t_f		200	ns
Turn-on energy	E_{on}		1.7	mJ
Turn-off energy	E_{off}		4.3	mJ
Total switching energy	E_{ts}		6	mJ

6 Mechanical Characteristics and Ratings

Description	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Mounting torque (Mounting to heat sink)		M6 Screw & washer	3	4	5	Nm
Mounting torque (Main terminal)		M6 Screw & washer	2.5	4	5	Nm
Weight				450		g
Single B-TRAN™ thermal resistance, junction-case	R_{thJ-C}			0.07	-	K/W

7 Recommended Operating Conditions

Description	Symbol	Conditions	Value	Unit
High Voltage Input	V_{BR}		1200	V
Control VCC Voltage	V_{CC}		12	V
Drive Voltage	$V_{DRV1/2}$		12	V
Control Input Voltage	$V_{IN1/2}$	w.r.t GND	+12	V
PWM Switching Frequency			<20	kHz

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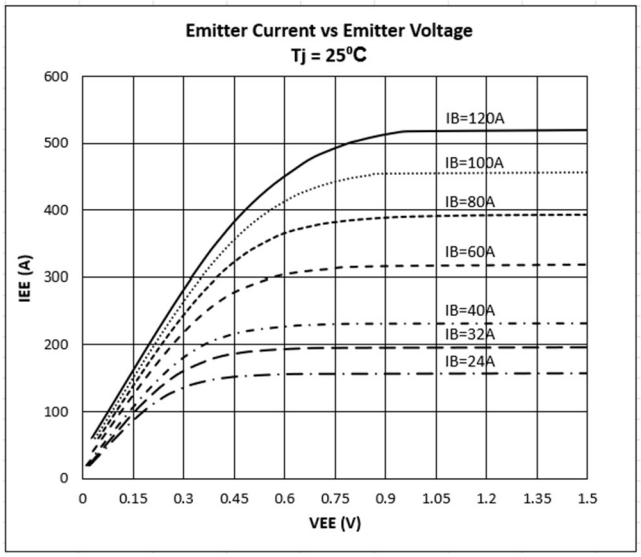
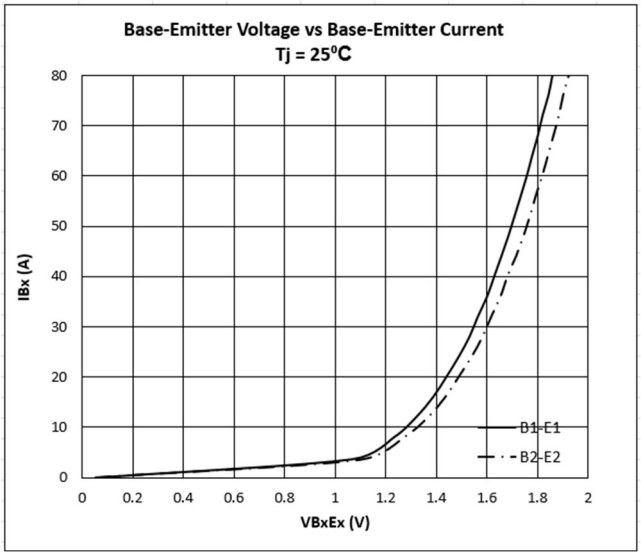
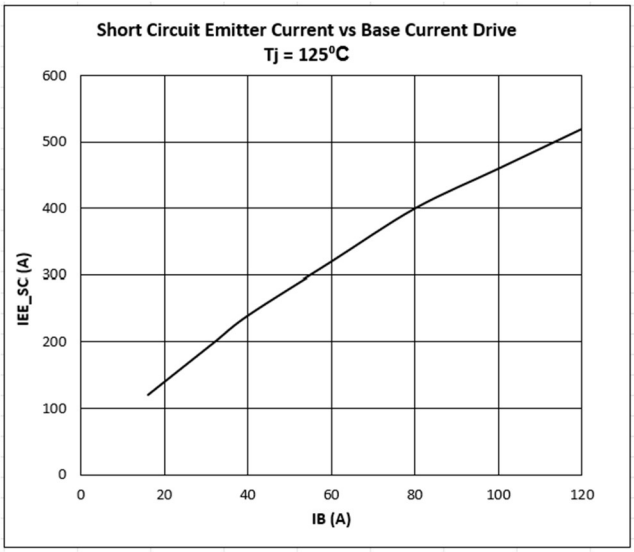
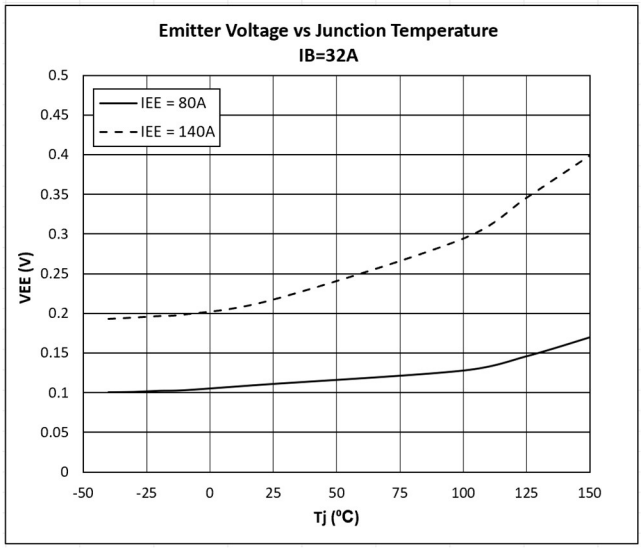
8 Performance Curves









9 Package Outline

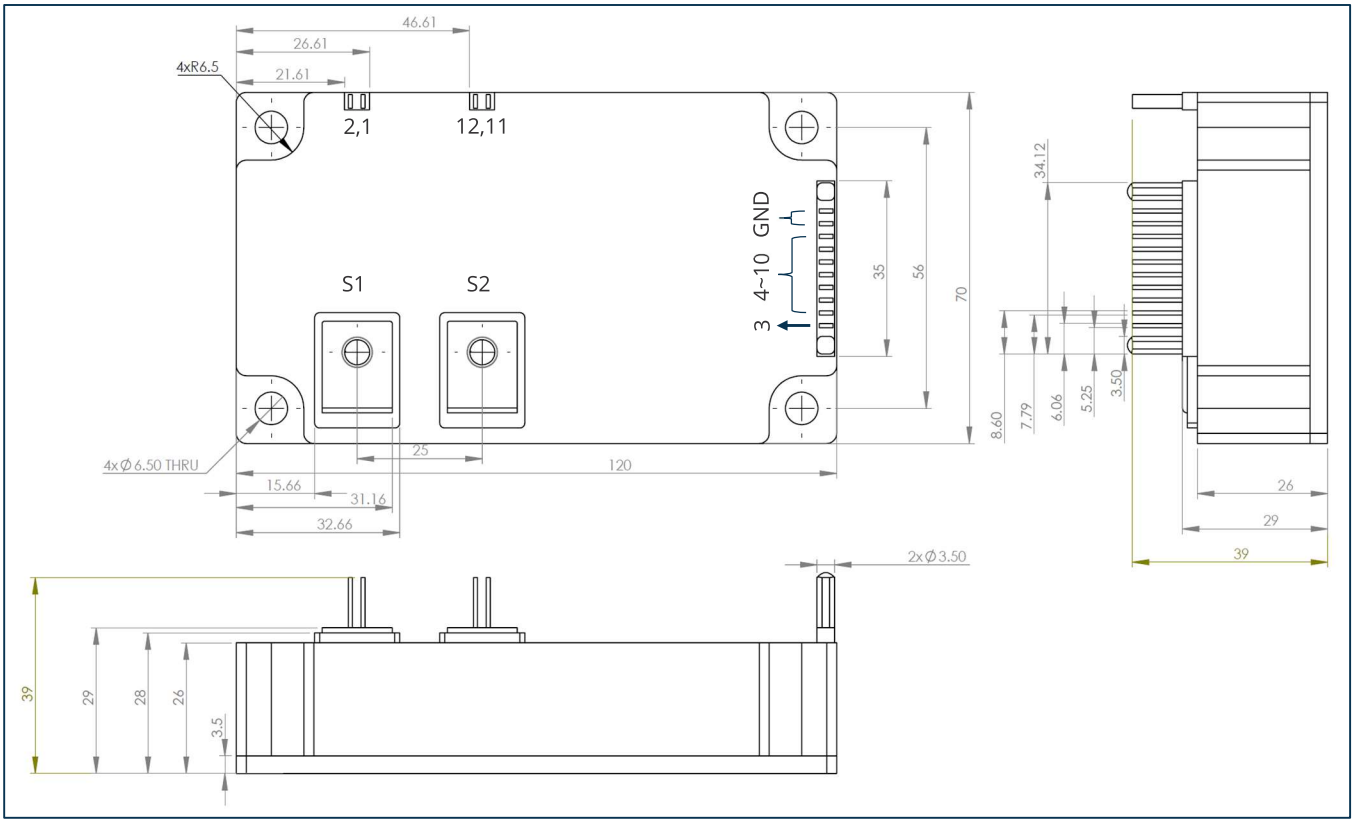


Figure 2 Package outline of SymCool™ IQ

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10 Switching Time Definition

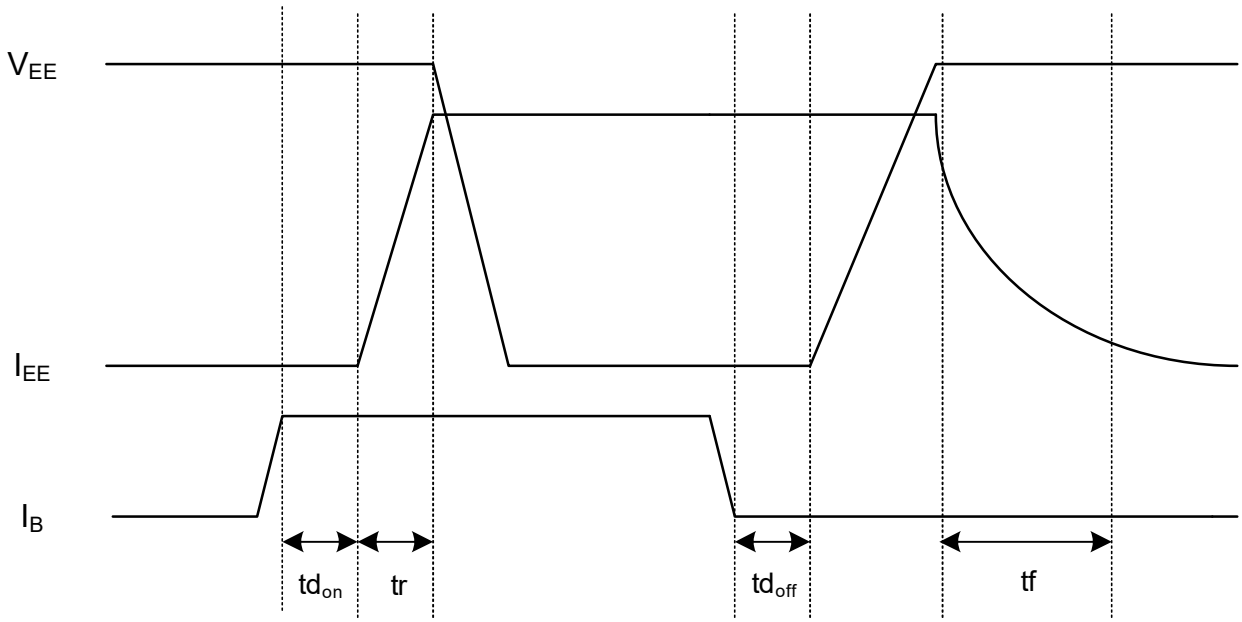

Figure 3 SymCool™ IQ Switching Time Definition

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Important Notices

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