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# Technical Specifications

## SymCool™ Power Module, 1200V/160A Bidirectional, Double-Sided Cooling

### Part Number: IPAM01216C12-ST

#### Description:

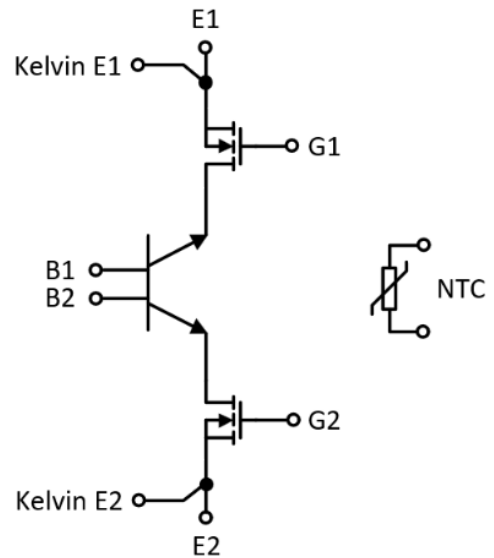
The SymCool™ is a bidirectional power module with a double-sided cooling package for superior thermal performance and efficiency. It is based on Ideal Power's innovative Si B-TRAN™ with ultra-low on-state voltage drop. It incorporates temperature sensing, Kelvin current sensing, and current sharing control, which reduces parasitic impedance and enhances protection. A cascode circuit is embedded in the package for normally-off operation.

#### Key Features:

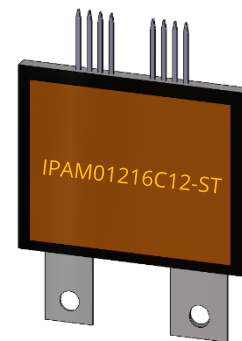
- Bidirectional Switching Operation
- Ultra-Low On-State Voltage Drop
- Low Switching Losses
- Double-Sided Cooling
- Switching Frequency: 30 KHZ
- Low Parasitic Inductance and Capacitance

#### Applications:

- Solid-State Circuit Breaker
- Battery Disconnect Switch
- Common-Emitter Applications
- T-Type Inverter
- Matrix Converter



Device Circuit Symbol



SymCool™ Package



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# 1 SymCool™ Power Module DC Electrical Characteristics

## Maximum Ratings

Parameter	Symbol	Value	Unit
Blocking voltage	$V_{BR}$	1200	V
DC emitter current $T_c = 25^\circ\text{C}$ $T_c = 100^\circ\text{C}$	$I_E$	240 160	A A
Pulsed emitter current	$I_{Epulse}$	400	A
Emitter-Base breakdown voltage	$V_{EB}$	50	V
Short circuit withstand time	$t_{SC}$	15	$\mu\text{s}$
Power dissipation $T_c = 25^\circ\text{C}$ Power dissipation $T_c = 100^\circ\text{C}$	$P_{tot}$	2000 800	W
Operating junction temperature	$T_{vj}$	-40...+150	$^\circ\text{C}$

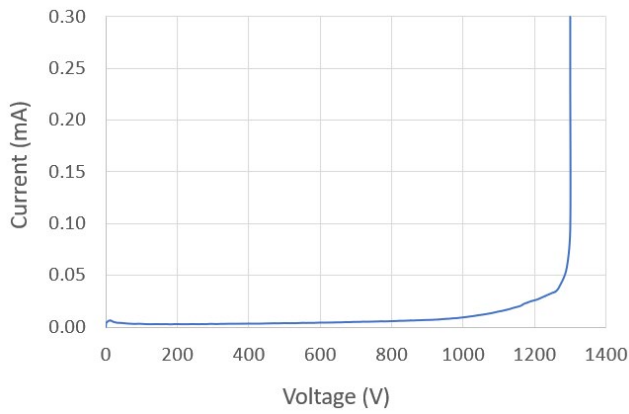
## Static Characteristics ( $T_j = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Blocking voltage	$V_{BR(E1B2)}$ or $V_{BR(E2B1)}$	$I_{E1E2} = 100 \mu\text{A}$	1200	1300	-	V
Emitter-Emitter saturation voltage	$V_{E1E2(on)}$	$V_{B1E1}$ or $V_{B2E2} = 1.5\text{V}$ , $I_{E1E2} = 160\text{A}$	---	0.6	0.8	V
Base-Emitter voltage (on-state)	$V_{B1E1}$ or $V_{B2E2}$	$I_{B1E1}$ or $I_{B2E2} = 1\text{A}$	1.4	1.5	1.6	V
Emitter-Base breakdown voltage (off-state)	$V_{R(B1E1)}$ or $V_{R(B2E2)}$	$I_{E1B1}$ or $I_{E2B2} = 1\text{mA}$	52	65	78	V
Emitter leakage current	$I_{E1B2}$ or $I_{E2B1}$	at $V_{E1B2}$ or $V_{E2B1} = 1200\text{V}$	---	200	400	$\mu\text{A}$
DC current gain	$h_{FE}$	$I_{E1E2} = 50\text{A}$		7	9	
	$h_{FE}$	$I_{E1E2} = 160\text{A}$		5	7	

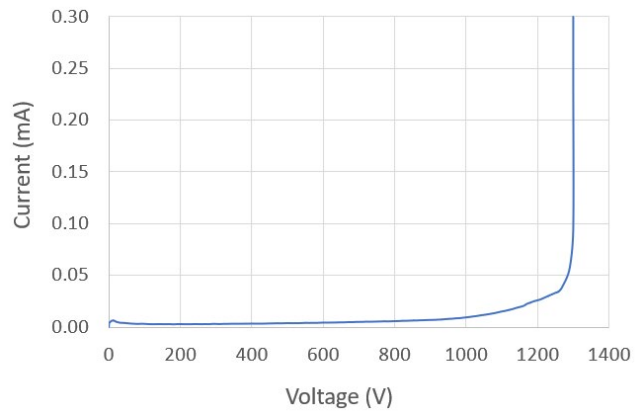




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(a) Front-side



(b) Back-side

Figure 1: Breakdown voltage test curves: Front-side  $V_{BR(E1B2)}$  & Back-side  $V_{BR(E2B1)}$

## 2 SymCool™ Power Module Switching Characteristics

### Switching Characteristics, Inductive Load ( $T_j = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Turn-on delay time	$t_{d(on)}$	$V_{E1E2} = 600\text{ V}, I_{E1E2} = 160\text{ A}$ $V_{B1E1}$ or $V_{B2E2} = 2\text{ V}$	250	ns
Rise time	$t_r$		100	ns
Turn-off delay time	$t_{d(off)}$		450	ns
Fall time	$t_f$		200	ns
Turn-on energy	$E_{on}$		2.0	mj
Turn-off energy	$E_{off}$		7.2	mj
Total switching energy	$E_{ts}$		9.2	mj



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## Switching Characteristics, Inductive Load ( $T_j = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value	Unit
Turn-on delay time	$t_{d(on)}$	$V_{E1E2} = 800\text{ V}$ , $I_{E1E2} = 60\text{ A}$ $V_{B1E1}$ or $V_{B2E2} = 2\text{ V}$	250	ns
Rise time	$t_r$		140	ns
Turn-off delay time	$t_{d(off)}$		450	ns
Fall time	$t_f$		250	ns
Turn-on energy	$E_{on}$		1.5	mj
Turn-off energy	$E_{off}$		5.8	mj
Total switching energy	$E_{ts}$		7.3	mj

$V_{E1E2(on)}$  Test:  $I_{E1E2(on)}$  at 120A,  $V_{E1E2(on)} = 0.61\text{V}$

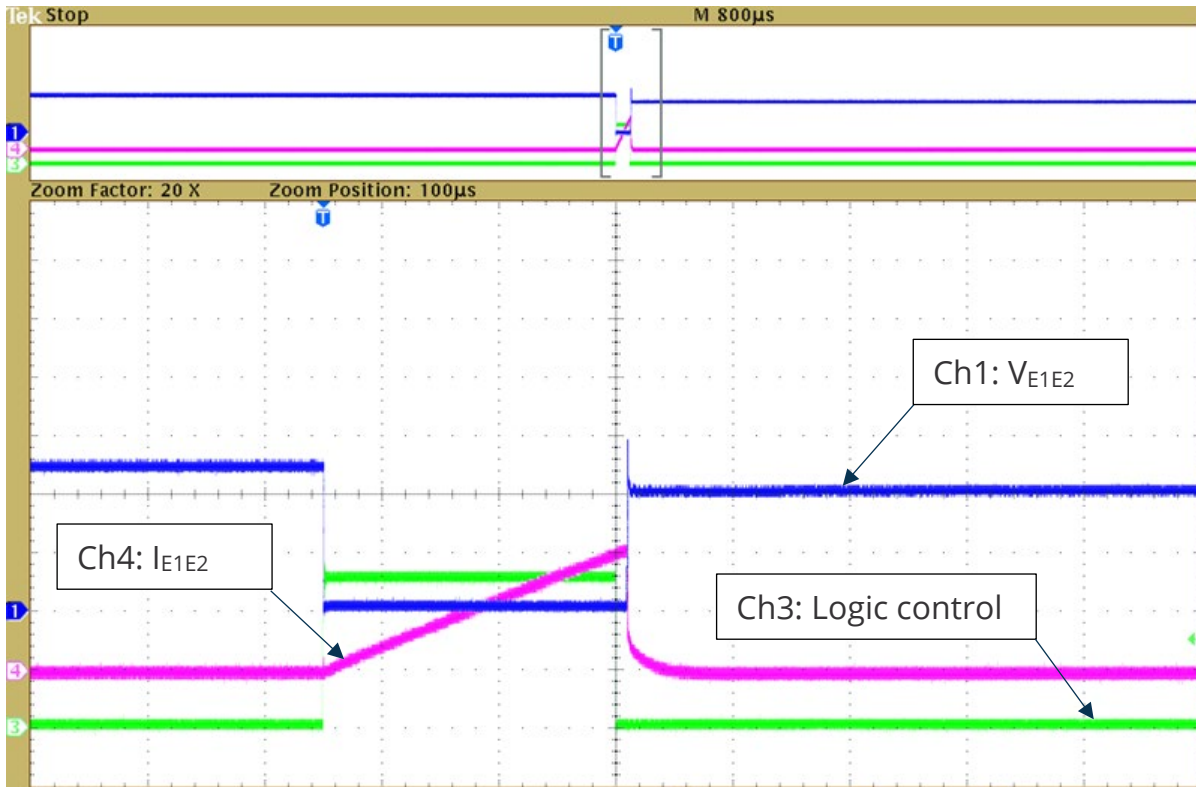


Figure 2:  $V_{E1E2(on)}$  test waveforms



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Double Pulse Test (DPT) Conditions:  $V_{E1E2} = 800V$ ,  $I_{E1E2} = 60A$

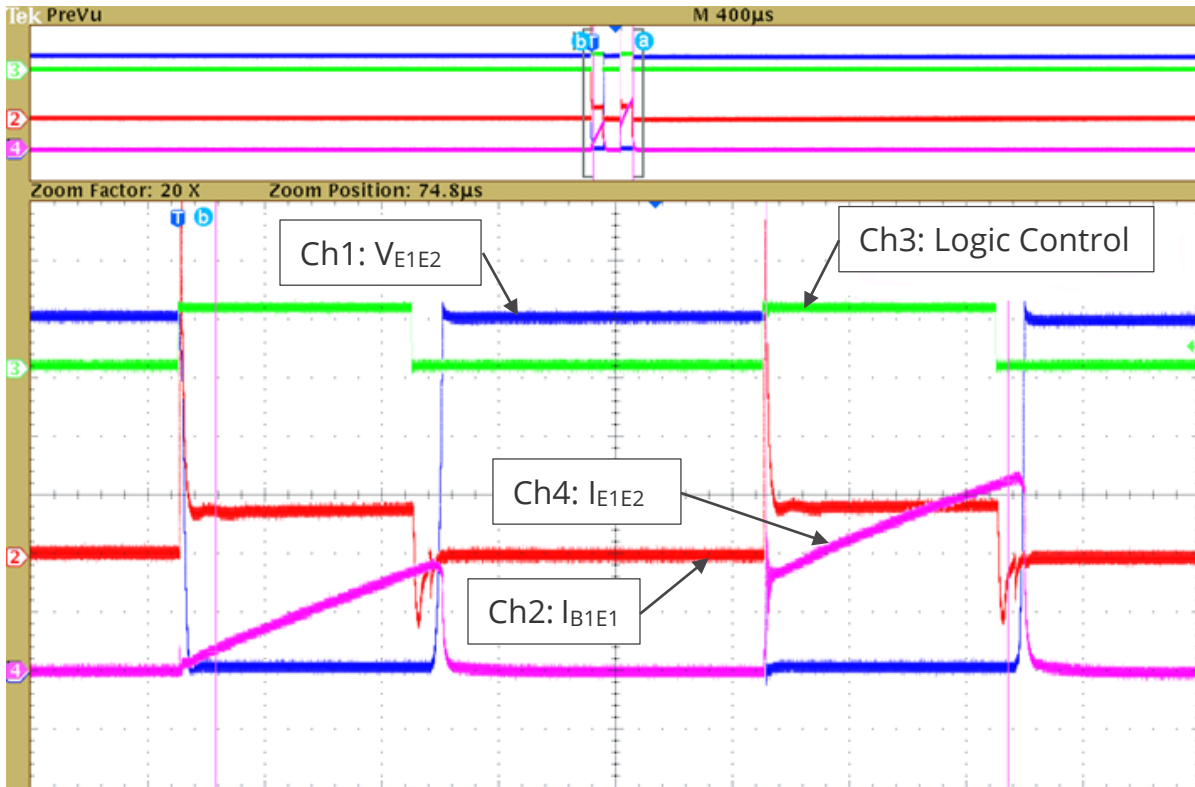


Figure 3: SymCool™ Power Module DPT waveforms



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### 3 NTC - Thermistor

#### Characteristics Values

Parameter	Value	Unit
Resistance value at 25 °C	5K	$\Omega$
Tolerance on R25-value	$\pm 1$	%
B <sub>25/85</sub> -value	3480	K
Tolerance on B <sub>25/85</sub> -value	$\pm 1$	%
Maximum dissipation at 25 °C	125	mW
Thermal time constant $\tau$	$\approx 8$	s
Dissipation factor D	3.0	mW/K
Operating temperature range at zero power	-40 to +150	°C
Weight	$\approx 0.006$	g



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## 4 SymCool™ Power Module Package Information

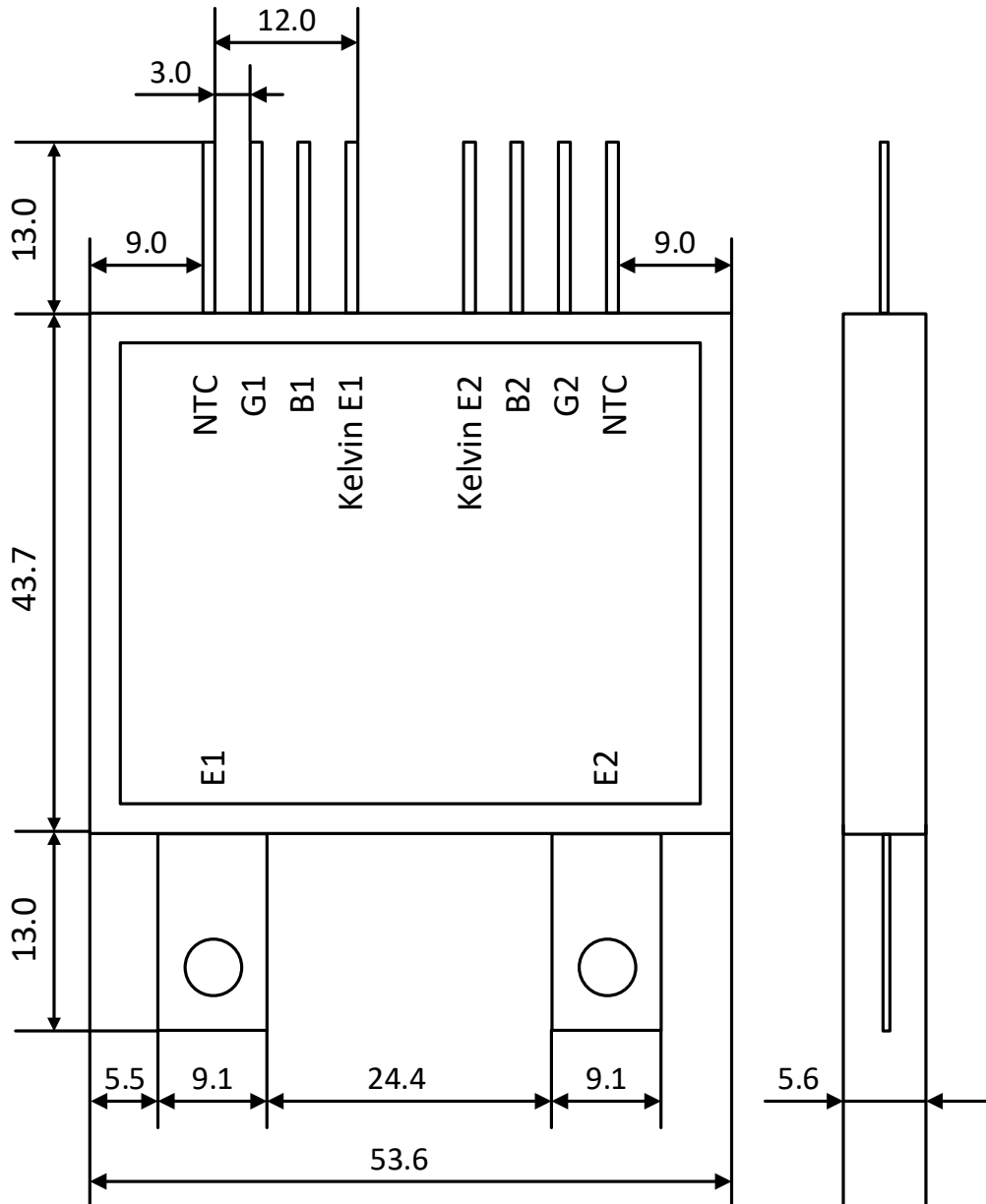


Figure 4: Mechanical outline of SymCool™ Power Module



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## Important Notices

SymCool™ Power Module specifications are subject to change. Ideal Power reserves the right to change limits, test conditions, and dimensions without notice. Information contained in this document are typical values and shall in no event be regarded as a guarantee of characteristics. With respect to any information regarding the application of the product, Ideal Power hereby disclaims all warranties and liabilities of any kind.

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For further information, please contact [sales@idealpower.com](mailto:sales@idealpower.com)



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