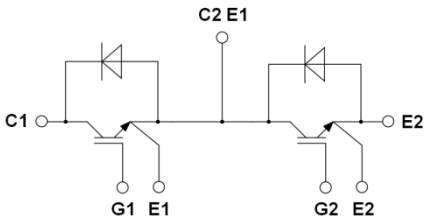
# 1200V, 40A, IGBT Module

## 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 BasePlate
- $Al_2O_3$ Basic Insulation

## Typical Applications

- Welding

## 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 | ±30 | 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 |
| - | turn off safe operating area，$V_{CE}$=1200V，Tj=150°C | 120 | A |
| $I_F$ | Diode Continuous Forward Current @$T_C$ = 100 °C | 20 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 60 | A |
| $P_D$ | Power Dissipation @$T_C$ = 25°C | 468 | W |
| | Power Dissipation @$T_C$ = 100 °C | 234 | W |
| $T_J$,$T_{stg}$ | Operating Junction and Storage Temperature Range | -55 to +175 | °C |
| $T_L$ | Maximum Temperature for Soldering | 260 | °C |

## IGBT 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 | | -- | -- | 0.10 | mA |
| $I_{GES(F)}$ | Gate to Emitter Forward Leakage | $V_{GE}$=+20V,$V_{CE}$=0V | | -- | -- | 100 | nA |
| $I_{GES(R)}$ | Gate to Source Reverse Leakage | $V_{GE}$=-20V,$V_{CE}$ =0V | | -- | -- | 100 | nA |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$=40A | Tj=25°C | -- | 2.0 | 2.4 | V |
| | | $V_{GE}$=15V | Tj=150°C | -- | 2.4 | -- | V |
| $V_{GE(th)}$ | Gate Threshold Voltage | $I_C$=1mA,$V_{CE}$=$V_{GE}$ | | 5.0 | -- | 6.5 | V |
| **Dynamic Characteristics** | | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=30V,$V_{GE}$=0V, f=1MHz | | -- | 6190 | -- | pF |
| $C_{oes}$ | Output Capacitance | | | -- | 185 | -- | |
| $C_{res}$ | Reverse Transfer Capacitance | | | -- | 133 | -- | |
| $Q_g$ | Total Gate Charge | $V_{CC}$=960V, $I_C$=40A, $V_{GE}$=15V | | -- | 242 | -- | nC |
| $Q_{ge}$ | Gate to Emitter Charge | | | -- | 51 | -- | |
| $Q_{gc}$ | Gate to Collector Charge | | | -- | 115 | -- | |
| **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 | | | -- | 2.1 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | -- | 1.2 | -- | |
| $E_{ts}$ | Total Switching Loss | | | -- | 3.3 | -- | |

## Diode Characteristics ($T_C$= 25°C unless otherwise specified)：

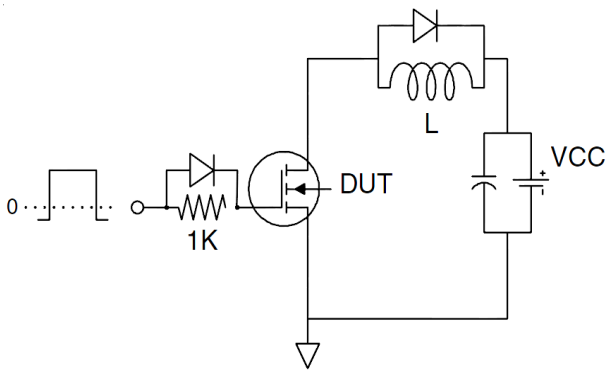
| Symbol | Parameter | Test Conditions | Rating | | | Units |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $V_{FM}$ | Diode Forward Voltage | $I_F$=20A | -- | 2.1 | 2.8 | V |
| $T_{rr}$ | Reverse Recovery Time | $I_F$=20A, di/dt=500A/us | -- | 203 | -- | ns |
| $I_{RRM}$ | Diode Peak Reverse Recovery Current | | -- | 10 | -- | A |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 1.6 | -- | uC |
| Pulse width $t_{tp}$≤380μs,δ≤2% | | | | | | |

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

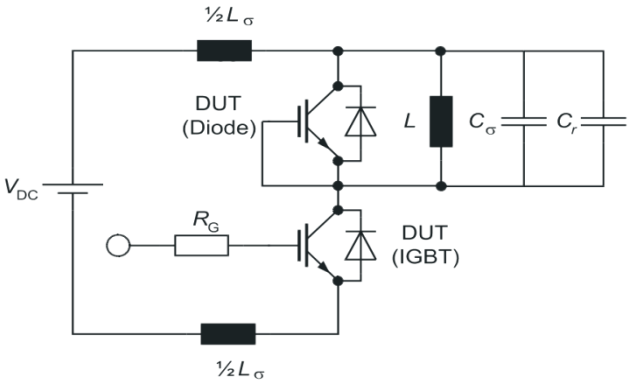
| Symbol | Parameter | Test Conditions | Rating | | | Units |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $V_{isol}$ | Isolation Voltage | f=50Hz, t=1min | 2500 | -- | -- | V |
| | Material of Module Baseplate | | | Cu | | |
| $T_{jmax}$ | Maximum Junction Temperature | | -- | -- | 150 | °C |
| $T_{vj\ op}$ | Operating Junction Temperature | | -40 | -- | 125 | °C |
| $T_{stg}$ | Storage Temperature | | -40 | -- | 125 | °C |
| $L_{SCE}$ | Stray-inductance-module | | -- | 30 | -- | nH |
| $R_{CC'+EE'}$ | Module lead resistance | $T_C$=25°C, per switch | -- | 0.75 | -- | mΩ |
| $R_{\theta JC}$ | Junction to case | pro IGBT/per IGBT | -- | 0.32 | -- | K/W |
| $R_{\theta JC}$ | Junction to case | pro Diode/per Diode | -- | 0.75 | -- | K/W |
| $R_{\theta CS}$ | Case to Sink | Conductive grease applied | -- | 0.05 | -- | K/W |
| $M_t$ | Module Electrodes Torque | Recommended(M5) | 2.5 | -- | 5.0 | Nm |
| $M_s$ | Module-to-Sink Torque | Recommended(M6) | 3.0 | -- | 5.0 | Nm |
| G | Weight of Module | | -- | 150 | -- | g |

## Test Circuit

### 1) Gate Charge Test Circuit

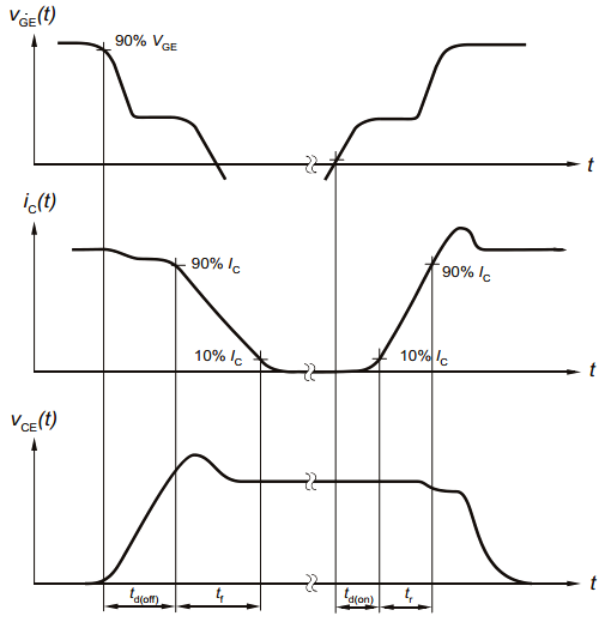



### 2) Switch Time Test Circuit

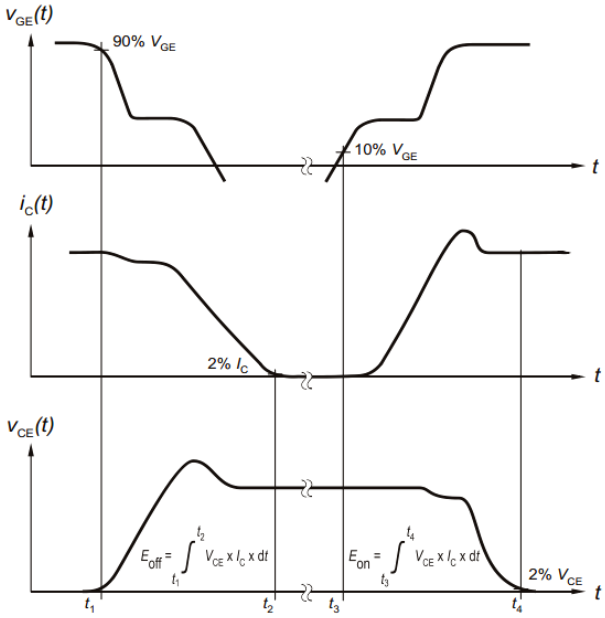



## Switching characteristics

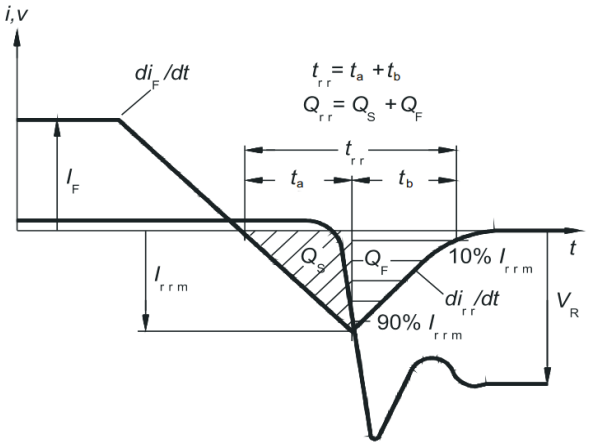
### 1) Definition of switching times




### 2) Definition of switching losses

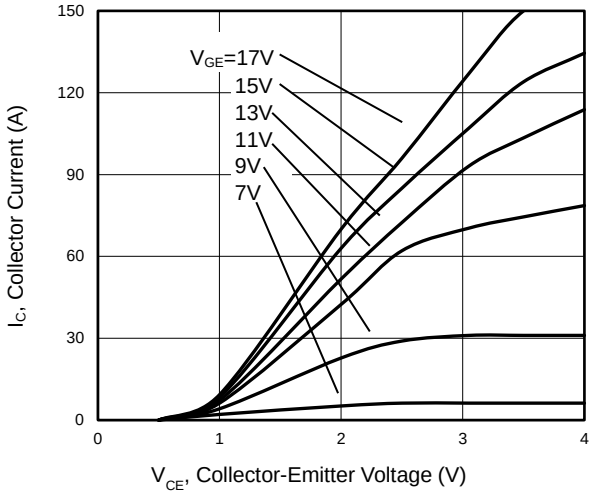



### 3) Definition of diode switching characteristics

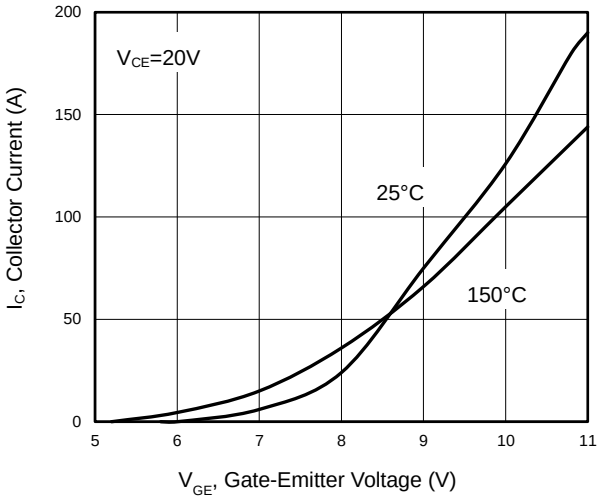


## Typical Electrical and Thermal Characteristics

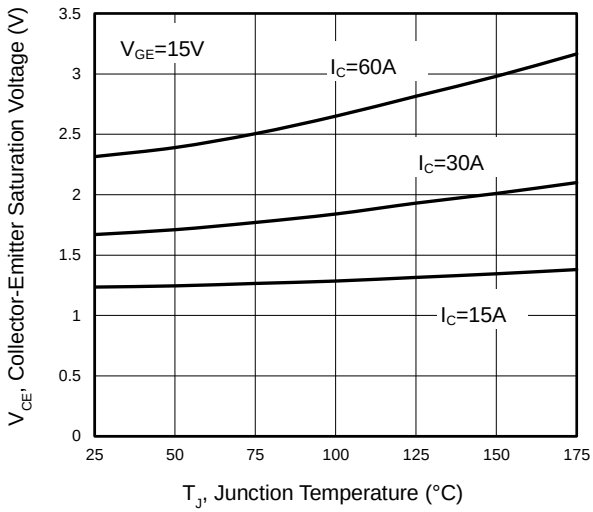
### Figure 1 Output Characteristics



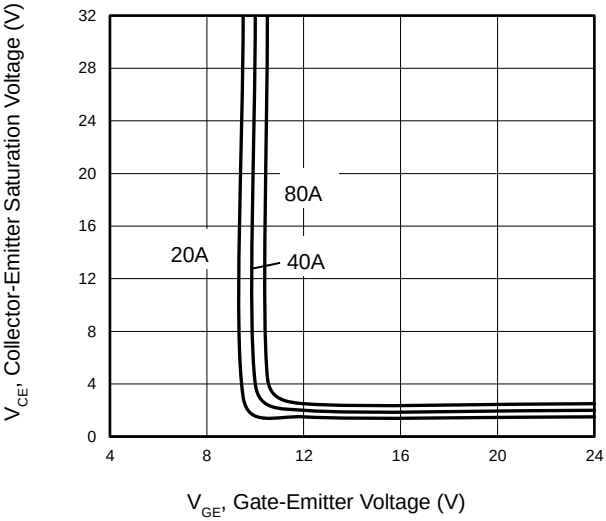

### Figure 2 Transfer Characteristics



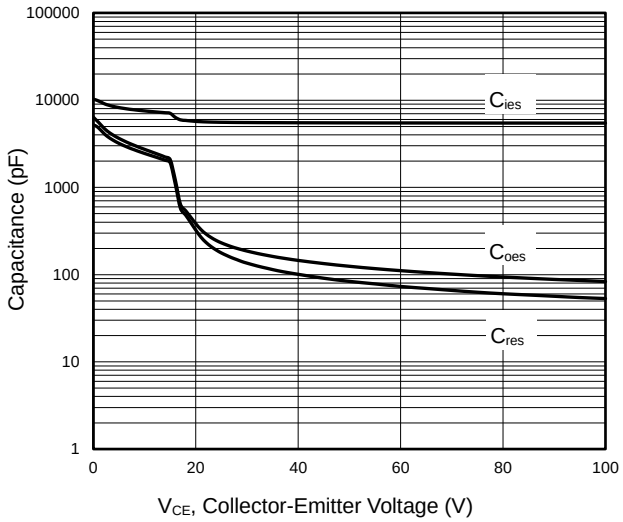

### Figure 3 $V_{CE(sat)}$ vs. Case Temperature



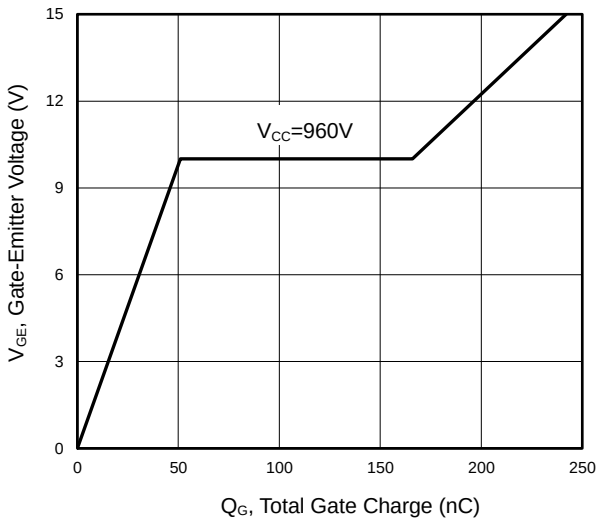

### Figure 4 Saturation Voltage vs. $V_{GE}$




### Figure 5 Capacitance Characteristics

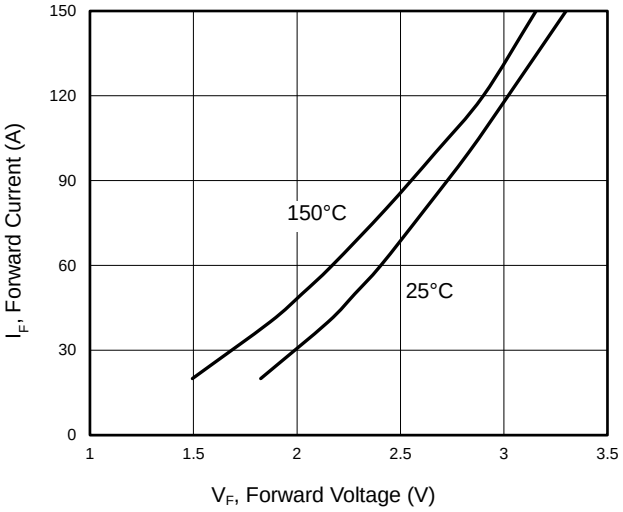



### Figure 6 Gate Charge Waveform

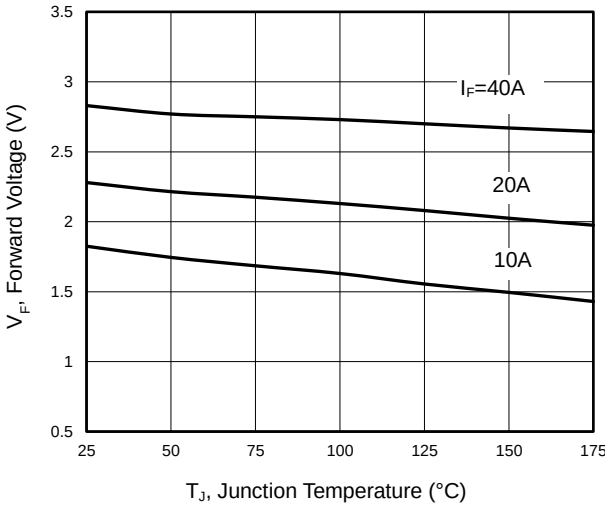


## Typical Electrical and Thermal Characteristics

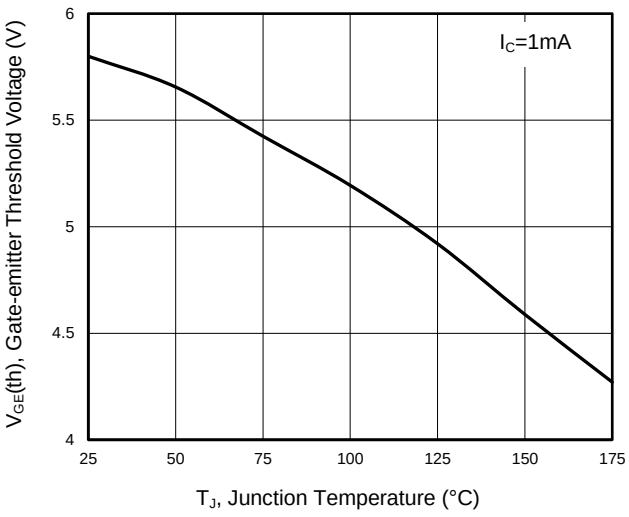
### Figure 7 Forward Characteristics



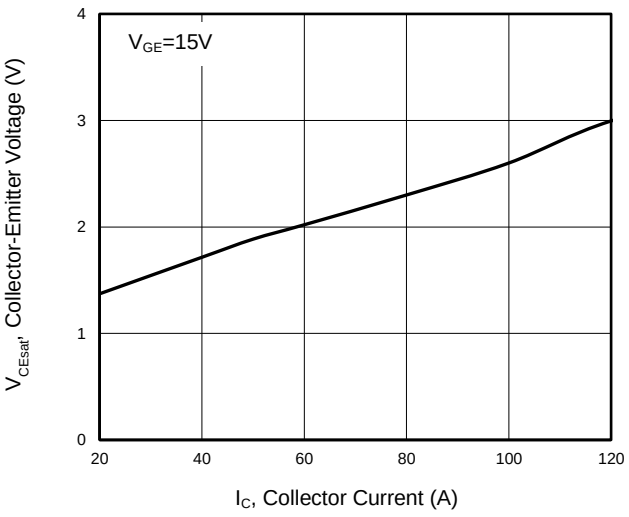

### Figure 8 $V_F$ vs. Temperature



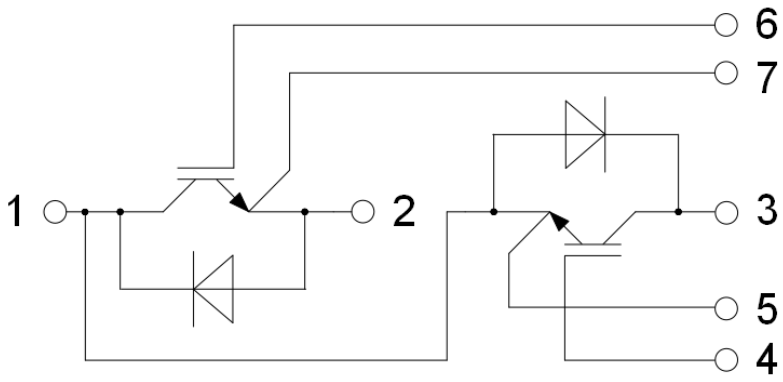

### Figure 9 Gate-emitter Threshold Voltage as a Function of Junction Temperature




### Figure 10 Typical Collector-emitter Saturation Voltage as a function of Collector Current

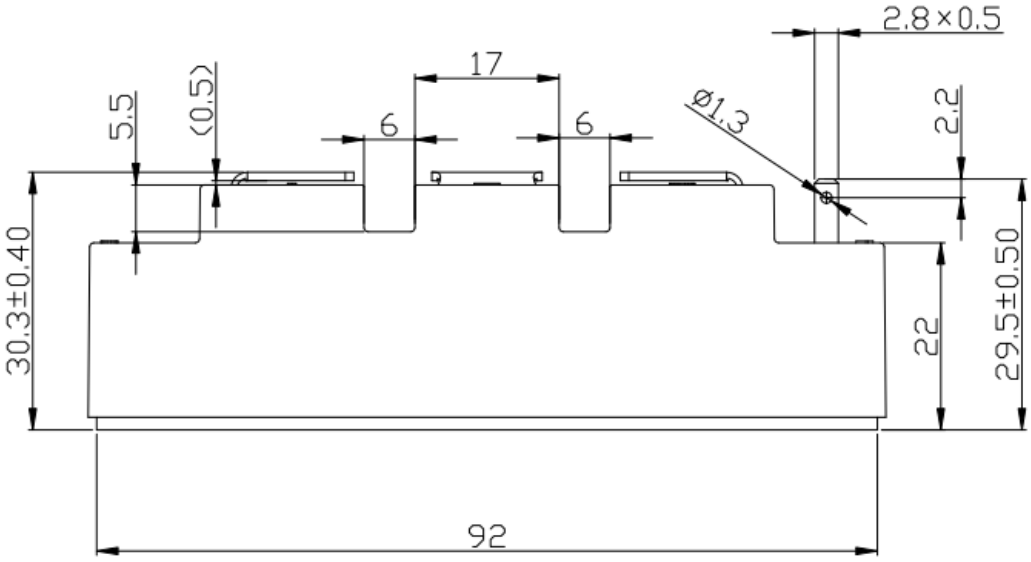


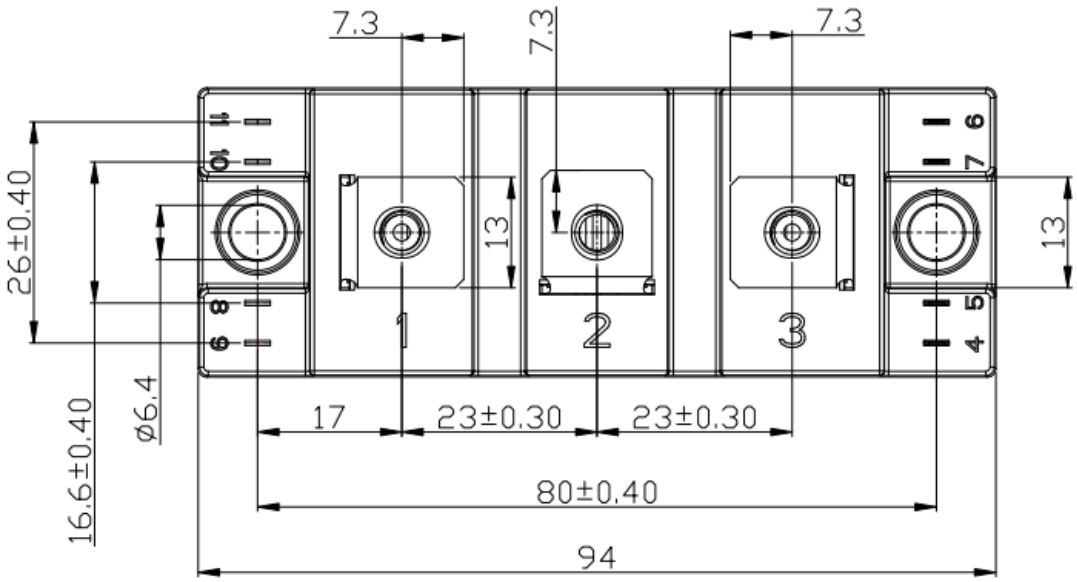
## Circuit Diagram




## Package Dimensions

### Dimensions in Millimeters



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