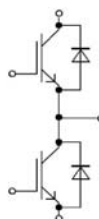


## High Speed IGBT in Trench and Fieldstop Technology



Equivalent circuit

### Features:

- 1200V 300A,  $V_{CE(sat)} = 1.85V @ 25^{\circ}C$
- High RBSOA capability
- Trench/FS technology
- Low reverse-recovery losses
- High SC capability

### Applications:

- Motor drives
- Solar applications
- UPS systems
- Commercial electric vehicles
- Wind turbines

### Mechanical Features:

- High power and thermal cycling capability
- High power density
- Press FIT contact technology
- Isolated base plate

### Key Performance and Package Parameters

| Type          | $V_{CES}$ | $I_{Cnom}$ | $V_{CEsat}, T_{vj}=25^{\circ}C$ | $T_{vjmax}$ | Marking       |
|---------------|-----------|------------|---------------------------------|-------------|---------------|
| PM300T2120HS1 | 1200V     | 300A       | 1.85V                           | 175°C       | PM300T2120HS1 |

### IGBT Inverter

#### Maximum Rated Values at $T_{vj}=25^{\circ}C$ (unless otherwise specified)

| Parameter                                            | Symbols   | Value      | Units |
|------------------------------------------------------|-----------|------------|-------|
| Collector-emitter voltage                            | $V_{CES}$ | 1200       | V     |
| Continuous DC collector current $T_c = 100^{\circ}C$ | $I_C$     | 300        | A     |
| Pulsed collector current Note *1                     | $I_{CP}$  | 600        | A     |
| Diode forward current                                | $I_F$     | 300        | A     |
| Gate-emitter peak voltage                            | $V_{GES}$ | $\pm 30$   | V     |
| Repetitive peak forward current                      | $I_{FRM}$ | 600        | A     |
| Operating junction temperature                       | $T_{vj}$  | -40 ~ +150 | °C    |
| Storage temperature                                  | $T_{stg}$ | -40 ~ +125 | °C    |

Note \*1 : Pulse width limited by  $T_{vjmax}$ .

## IGBT, Inverter

### Characteristic Values (unless otherwise specified)

| Parameter                            | Symbols             | Conditions                                                                                                                                                                                                    | Value                                                                     |                      |                         | Unit        |    |
|--------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------|-------------------------|-------------|----|
|                                      |                     |                                                                                                                                                                                                               | Min                                                                       | Typ                  | Max                     |             |    |
| Collector-emitter saturation voltage | V <sub>CEsat</sub>  | I <sub>C</sub> =300A, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C<br>I <sub>C</sub> =300A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C<br>I <sub>C</sub> =300A, V <sub>GE</sub> =15V, T <sub>vj</sub> =150°C | -<br>-<br>-                                                               | 1.85<br>2.27<br>2.40 | 2.2<br>-<br>-           | V           |    |
| Gate-emitter threshold voltage       | V <sub>GE(th)</sub> | I <sub>C</sub> =11.5mA, V <sub>CE</sub> =V <sub>GE</sub> , T <sub>vj</sub> =25°C                                                                                                                              | 5.6                                                                       | 6.1                  | 6.6                     | V           |    |
| Collector-emitter leakage current    | I <sub>CES</sub>    | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C                                                                                                                                            | -                                                                         | -                    | 200                     | uA          |    |
| Gate-emitter leakage current         | I <sub>GES</sub>    | V <sub>CE</sub> =0V, V=20V T <sub>vj</sub> =25°C                                                                                                                                                              | -                                                                         | -                    | ±300                    | nA          |    |
| Input capacitance                    | C <sub>ies</sub>    | f=1MHz, V <sub>CE</sub> =25V, V <sub>GE</sub> =0V                                                                                                                                                             | -                                                                         | 40                   | -                       | nF          |    |
| Reverse transfer capacitance         | C <sub>res</sub>    | f=1MHz, V <sub>CE</sub> =25V, V <sub>GE</sub> =0V                                                                                                                                                             | -                                                                         | 0.19                 | -                       | nF          |    |
| Gate charge                          | Q <sub>G</sub>      | V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V                                                                                                                                                                 | -                                                                         | 1450                 | -                       | nC          |    |
| Turn-on delay time inductive load    | t <sub>d(on)</sub>  | V <sub>CC</sub> =600V<br>I <sub>C</sub> =300A<br>V <sub>GE</sub> =15V<br>R <sub>G</sub> =20Ω                                                                                                                  | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 0.78<br>0.70<br>0.67    | -<br>-<br>- | μs |
| Rise time inductive load             | t <sub>r</sub>      |                                                                                                                                                                                                               | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 0.35<br>0.37<br>0.37    | -<br>-<br>- | μs |
| Turn-off delay time inductive load   | t <sub>d(off)</sub> |                                                                                                                                                                                                               | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 1.17<br>1.20<br>1.20    | -<br>-<br>- | μs |
| Fall time inductive load             | t <sub>f</sub>      |                                                                                                                                                                                                               | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 0.087<br>0.104<br>0.104 | -<br>-<br>- | μs |
| Turn-on switching loss               | E <sub>on</sub>     |                                                                                                                                                                                                               | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 68.74<br>99.02<br>99.33 | -<br>-<br>- | mJ |
| Turn-off switching loss              | E <sub>off</sub>    |                                                                                                                                                                                                               | T <sub>vj</sub> =25°C<br>T <sub>vj</sub> =125°C<br>T <sub>vj</sub> =150°C | -<br>-<br>-          | 30.97<br>33.66<br>32.38 | -<br>-<br>- | mJ |

### Thermal resistance

| Parameter                                       | Symbols       | Value |     |     | Units |
|-------------------------------------------------|---------------|-------|-----|-----|-------|
|                                                 |               | Min   | Typ | Max |       |
| Thermal resistance, per IGBT junction to case   | $R_{th(j-c)}$ | -     | -   | 0.2 | K/W   |
| Thermal resistance, per diodes junction to case | $R_{th(j-c)}$ | -     | -   | 0.3 |       |

## Diode, Inverter

### Characteristic Values (unless otherwise specified)

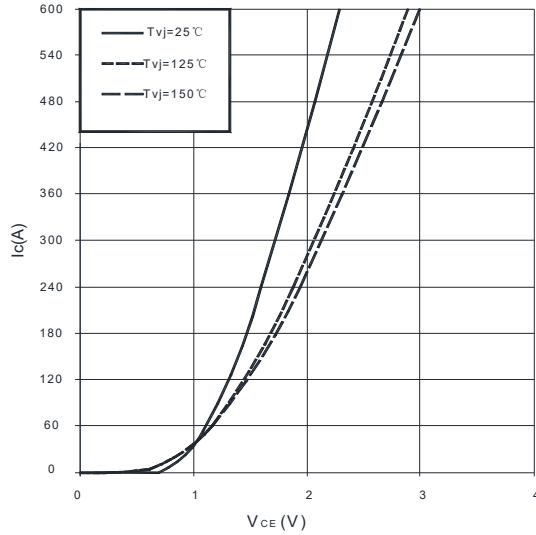
| Parameter               | Symbols   | Conditions                                                      | Value                 |     |       | Unit |
|-------------------------|-----------|-----------------------------------------------------------------|-----------------------|-----|-------|------|
|                         |           |                                                                 | Min                   | Typ | Max   |      |
| Forward voltage         | $V_F$     | $I_F=300A, V_{GE}=0V$                                           | $T_{vj}=25^{\circ}C$  | -   | 1.56  | 2.5  |
|                         |           |                                                                 | $T_{vj}=125^{\circ}C$ | -   | 1.40  | -    |
|                         |           |                                                                 | $T_{vj}=150^{\circ}C$ | -   | 1.35  | -    |
| Recovery charge         | $Q_r$     | $I_F=300A, V_R=600V$<br>$-di_F/dt=900A/\mu s,$<br>$V_{GE}=-15V$ | $T_{vj}=25^{\circ}C$  | -   | 18.12 | -    |
|                         |           |                                                                 | $T_{vj}=125^{\circ}C$ | -   | 59.06 | -    |
|                         |           |                                                                 | $T_{vj}=150^{\circ}C$ | -   | 51.63 | -    |
| Reverse recovery energy | $E_{rec}$ | $I_F=300A, V_R=600V$<br>$-di_F/dt=900A/\mu s$<br>$V_{GE}=-15V$  | $T_{vj}=25^{\circ}C$  | -   | 5.01  | -    |
|                         |           |                                                                 | $T_{vj}=125^{\circ}C$ | -   | 20.41 | -    |
|                         |           |                                                                 | $T_{vj}=150^{\circ}C$ | -   | 16.76 | -    |

## Module

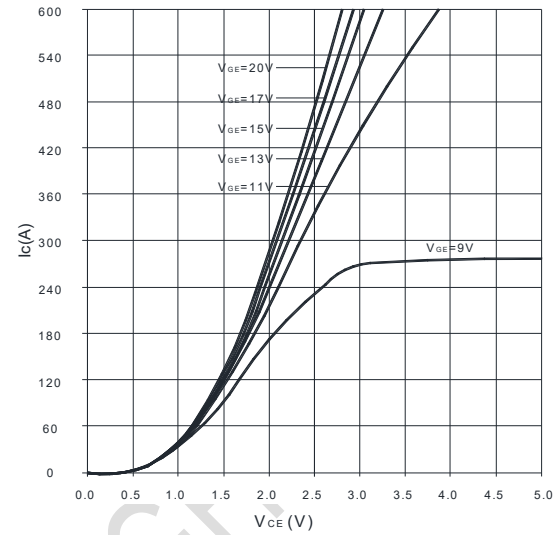
| Parameter                    | Symbols     | Conditions            | Value |           |   | Unit |
|------------------------------|-------------|-----------------------|-------|-----------|---|------|
| Isolation voltage            | $V_{ISOL}$  | $f=50Hz, t=1min, RMS$ | -     | 4000      | - | V    |
| Material of module base plat |             |                       | -     | Cu        | - |      |
| Internal isolation           |             |                       | -     | $Al_2O_3$ | - |      |
| Creepage distance            | $d_{Creep}$ | Terminal to terminal  | -     | 20.1      | - | mm   |
| Clearance                    | $d_{Clear}$ | Terminal to terminal  | -     | 9.5       | - | mm   |
| Comparative tracking index   | CTI         |                       | -     | 200       | - |      |

| Parameter                              | Symbols       | Conditions                    | Value |      |     | Unit |
|----------------------------------------|---------------|-------------------------------|-------|------|-----|------|
|                                        |               |                               | Min   | Typ  | Max |      |
| Stray inductance module                | $L_{sCE}$     |                               | -     | 29.2 | -   | nH   |
| Module lead resistance ,terminals-chip | $R_{CC'+EE'}$ | $TC=25^{\circ}C, Per\ switch$ | -     | 0.66 | -   | mΩ   |
| Mounting torque for module mounting    | M             | Screw M5                      | 3.0   |      | 5.0 | Nm   |
| Weight                                 | G             |                               | -     | 156  | -   | g    |

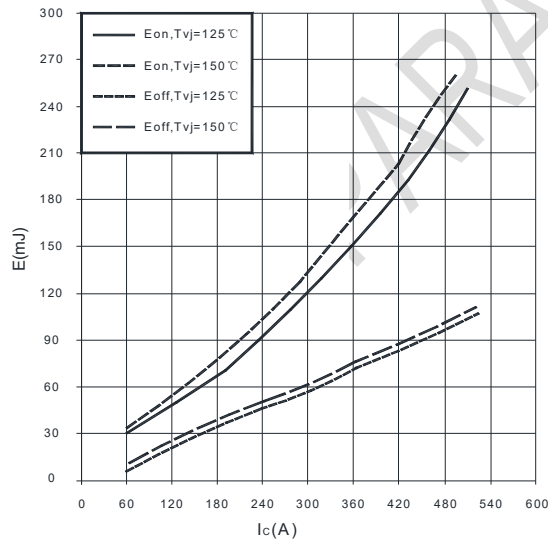
## Typical Characteristics



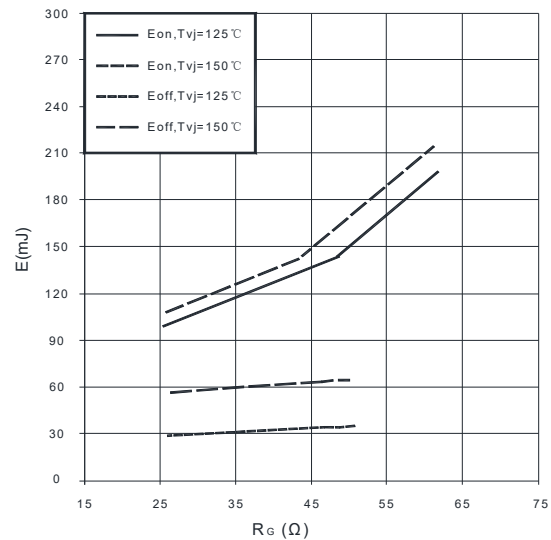
**Fig 1. Output characteristic (typical), IGBT, Inverter IGBT, Inverter  $I_c = f(V_{CE})$   $V_{GE} = 15V$**



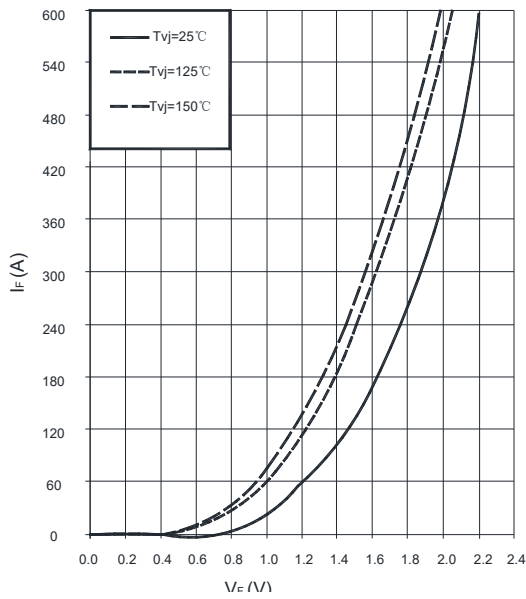
**Fig 2. Output characteristic (typical),  $I_c = f(V_{CE})$   $T_{vj} = 150^\circ C$**



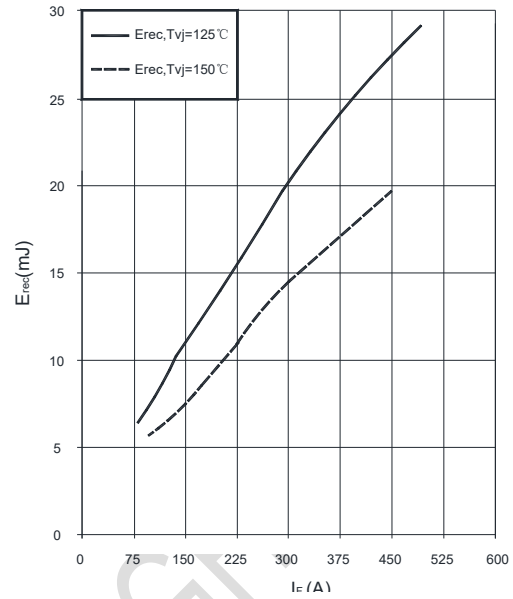
**Fig 3. Switching losses (typical), IGBT, Inverter  $E = f(I_c)$   $R_{GoFF} = 20\Omega$ ,  $R_{Gon} = 20\Omega$ ,  $V_{GE} = \pm 15V$ ,  $V_{cc} = 600V$**



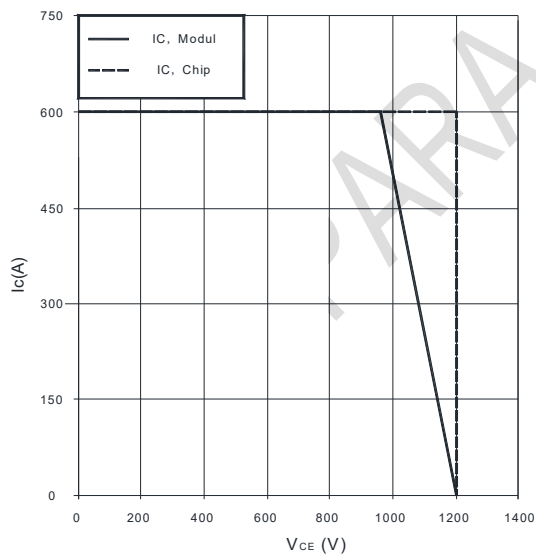
**Fig 4. Switching losses (typical), IGBT, Inverter  $E = f(R_G)$   $V_{GE} = 15V$ ,  $I_c = 300A$ ,  $V_{cc} = 600V$**



**Fig 5. Forward characteristic (typical), Diode, Inverter  $I_F = f(V_F)$**

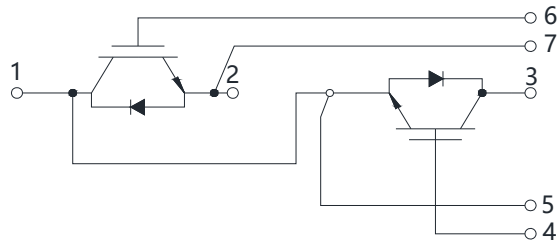


**Fig 6. Switching losses (typical), Diode, Inverter  $E_{rec} = f(I_F)$   $R_{Gon} = 20\Omega$ ,  $V_{CC} = 600V$**

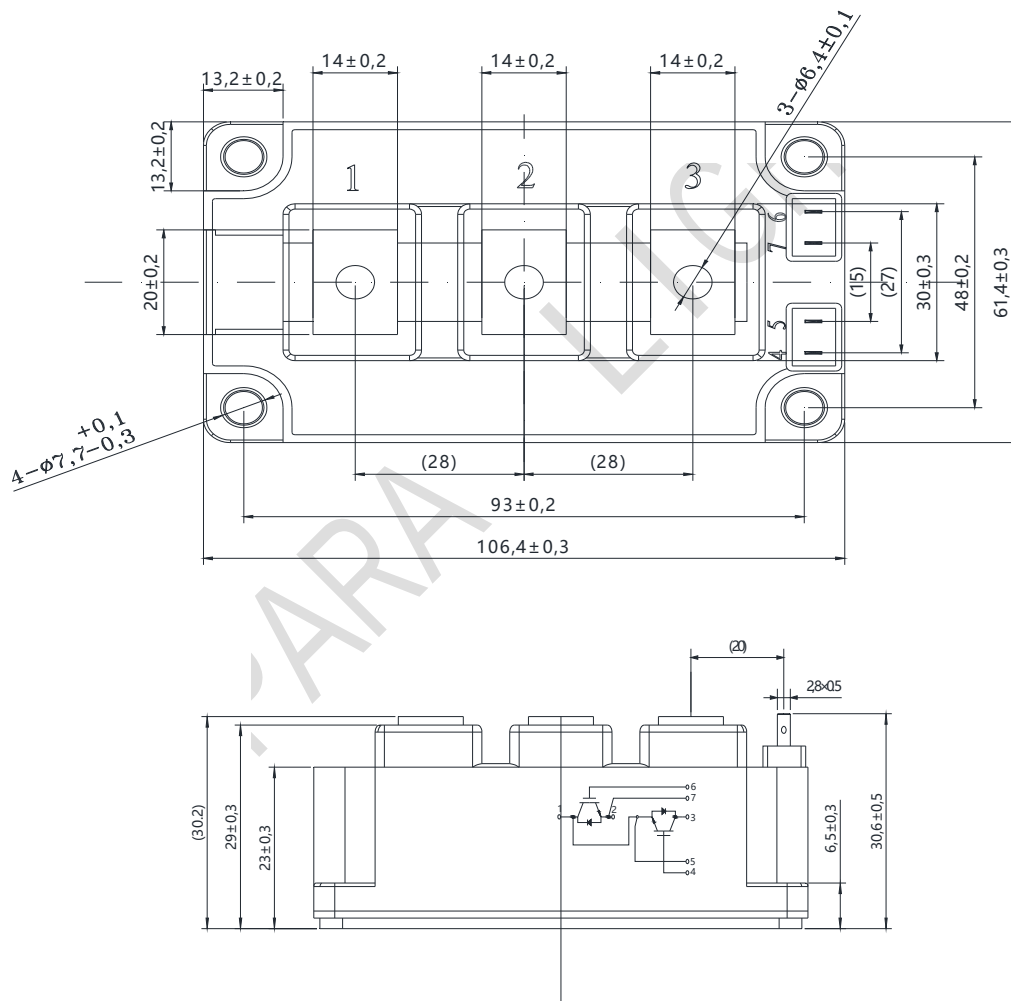


**Fig 7. Reverse bias safe operating area (RBSOA), IGBT, Inverter  $I_C = f(V_{CE})$   $R_{Goff} = 20\Omega$ ,  $V_{GE} = \pm 15V$ ,  $T_{vj} = 150^\circ C$**

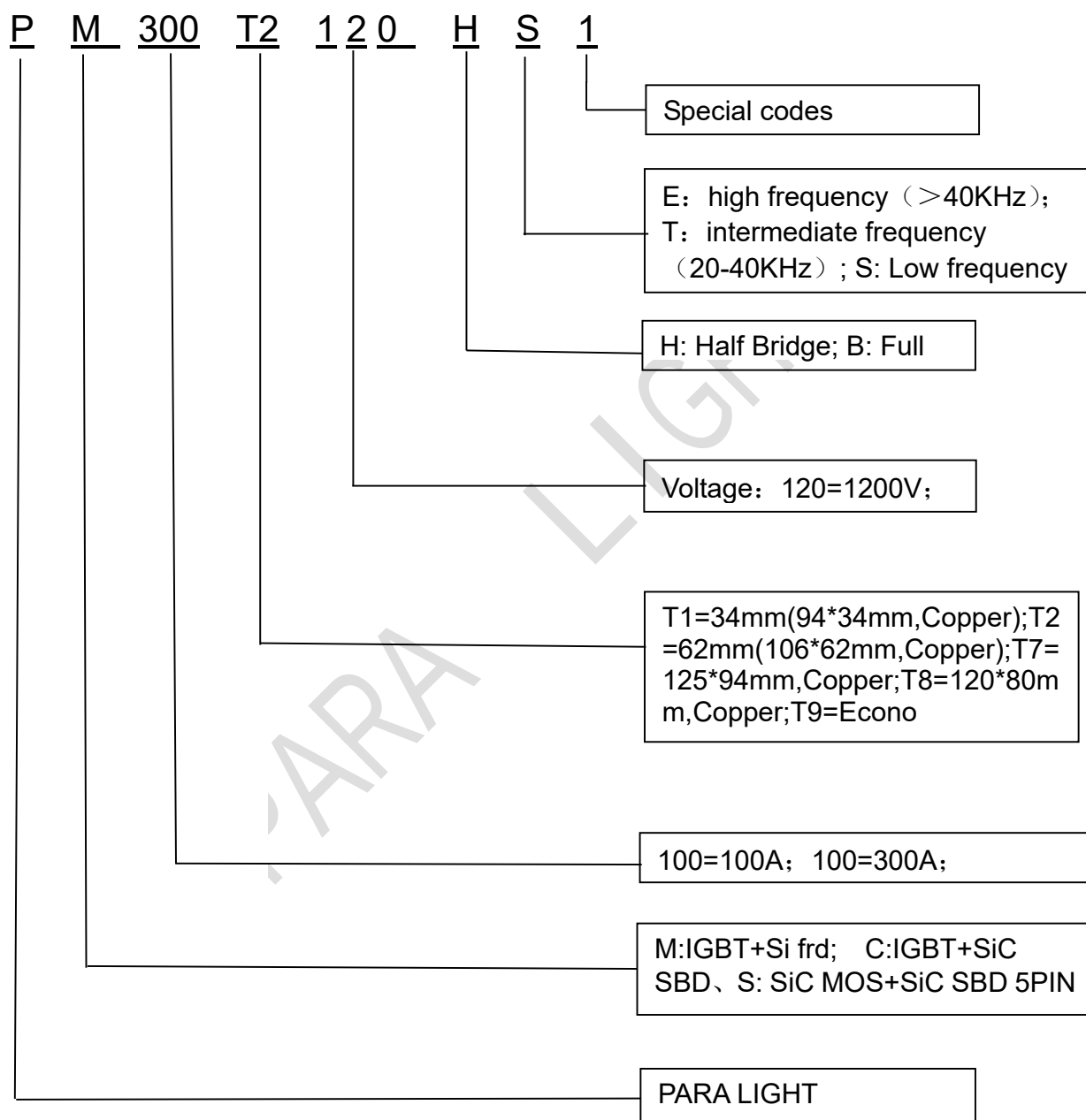
### Circuit\_diagram\_headline



### Package outline



**PART NO. SYSTEM :**



## Revision history

### Document revision history

| Date       | Version | Changes        |
|------------|---------|----------------|
| 2024.09.29 | A / 0   | First release. |
|            |         |                |
|            |         |                |
|            |         |                |
|            |         |                |