

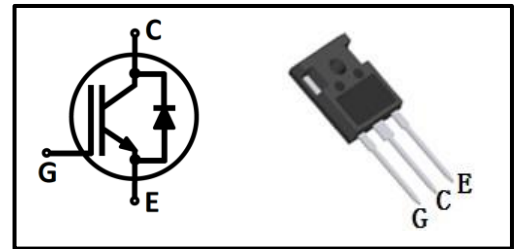
Features

- Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Low V_{CEsat} , fast switching
- High ruggedness, good thermal stability
- Very tight parameter distribution

Applications

- Welding Machine
- UPS
- Home Fitness

| Type | Marking | Package Code |
|-------------|-----------|--------------|
| MPBW50N65EC | MP50N65EC | TO-247-3 |



Maximum Rated Values ¹

| Parameter | Symbol | Value | Unit |
|---|-------------|----------|------------------|
| Collector-emitter voltage | V_{CE} | 650 | V |
| DC collector current ² | | | A |
| $T_C=25^\circ\text{C}$ | I_C | 80 | |
| $T_C=100^\circ\text{C}$ | | 50 | |
| Pulsed collector current ³ | I_{Cpuls} | 200 | |
| Diode forward current ² | | | |
| $T_C=25^\circ\text{C}$ | I_F | 40 | |
| $T_C=100^\circ\text{C}$ | | 20 | |
| Diode pulsed current ³ | I_{Fpuls} | 200 | |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$) | | ± 30 | |
| Power dissipation | | | W |
| $T_C=25^\circ\text{C}$ | P_{tot} | 300 | |
| $T_C=100^\circ\text{C}$ | | 150 | |
| Operating junction temperature | T_j | -55~175 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55~150 | |

1:Reference standard: JESD-022 2: limited by T_{jmax} 3: T_p limited by T_{jmax} ;



Thermal Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|-------------|-----|-----|------|------|
| IGBT thermal resistance, junction-case | R_{thJC} | - | - | 0.5 | K/W |
| Diode thermal resistance, junction-case | R_{thJCD} | - | - | 0.65 | |
| Thermal Resistance, junction-ambient | R_{thJA} | - | - | 40 | |

Electrical Characteristics (at $T_j=25^\circ\text{C}$, unless otherwise specified) Static Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|---------------|--|-----|------|------|------|
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=0.25mA$ | 650 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=50A, T_j=25^\circ\text{C}$ | - | 1.60 | 2.00 | |
| | | $T_j=125^\circ\text{C}$ | - | 1.95 | - | |
| | | $T_j=150^\circ\text{C}$ | - | 2.05 | - | |
| Diode forward voltage | V_F | $V_{GE}=0V, I_F=20A, T_j=25^\circ\text{C}$ | - | 1.60 | 1.90 | |
| | | $T_j=125^\circ\text{C}$ | - | 1.40 | - | |
| | | $T_j=150^\circ\text{C}$ | - | 1.35 | - | |
| G-E threshold voltage | $V_{GE(th)}$ | $I_C=1mA, V_{CE}=V_{GE}$ | 4.5 | 5.5 | 6.5 | |
| C-E leakage current | I_{CES} | $V_{CE}=650V, V_{GE}=0V, T_j=25^\circ\text{C}$ | - | - | 0.01 | mA |
| | | $T_j=150^\circ\text{C}$ | - | - | 1.0 | |
| G-E leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | - | - | 250 | nA |
| Transconductance | g_{FS} | $V_{CE}=20V, I_C=50A$ | - | 21 | - | S |

Dynamic Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|------------------------------|------------|------------------------------------|-----|------|-----|------|
| Input capacitance | C_{iss} | $V_{CE}=25V, V_{GE}=0V, f=1MHz$ | - | 5810 | - | pF |
| Output capacitance | C_{oss} | | - | 130 | - | |
| Reverse transfer capacitance | C_{riss} | | - | 65 | - | |
| Gate charge | Q_G | $V_{CC}=300V, I_C=50A, V_{GE}=15V$ | - | 230 | - | nC |



IGBT Switching Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit | |
|------------------------|--------------|--|--|-----|------|------|----|
| Turn-on delay time | $t_{d(on)}$ | $T_j=25^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load | - | 167 | - | ns | |
| Rise time | t_r | | - | 97 | - | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 316 | - | | |
| Fall time | t_f | | $T_j=125^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load | - | 68 | - | mJ |
| Turn-on energy | E_{on} | | | - | 1.52 | - | |
| Turn-off energy | E_{off} | | | - | 1.41 | - | |
| Total switching energy | E_{ts} | | | - | 2.93 | - | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=125^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load | - | 160 | - | ns | |
| Rise time | t_r | | - | 87 | - | | |
| Turn-off delay time | $t_{d(off)}$ | | - | 350 | - | | |
| Fall time | t_f | | $T_j=125^{\circ}\text{C}$, $V_{CC}=400\text{V}$, $I_C=50\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Inductive load | - | 76 | - | mJ |
| Turn-on energy | E_{on} | | | - | 2.23 | - | |
| Turn-off energy | E_{off} | | | - | 1.97 | - | |
| Total switching energy | E_{ts} | | | - | 4.20 | - | |

Diode Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|-----------|---|-----|------|-----|---------------|
| Diode reverse recovery time | t_{rr} | $T_j=25^{\circ}\text{C}$, $V_R=400\text{V}$, $I_F=20\text{A}$, $di_F/dt=220\text{A}/\mu\text{s}$ | - | 87 | - | ns |
| Diode reverse recovery charge | Q_{rr} | | - | 0.25 | - | μC |
| Diode peak reverse recovery current | I_{rrm} | | - | 6.0 | - | A |
| Diode reverse recovery time | t_{rr} | $T_j=125^{\circ}\text{C}$, $V_R=400\text{V}$, $I_F=20\text{A}$, $di_F/dt=220\text{A}/\mu\text{s}$ | | 240 | | ns |
| Diode reverse recovery charge | Q_{rr} | | | 1.10 | | μC |
| Diode peak reverse recovery current | I_{rrm} | | | 10 | | A |

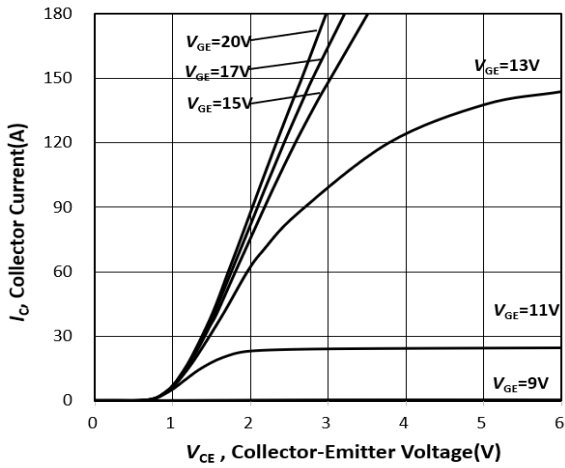


Figure 1. Typical output characteristic ($T_j = 25^\circ C$)

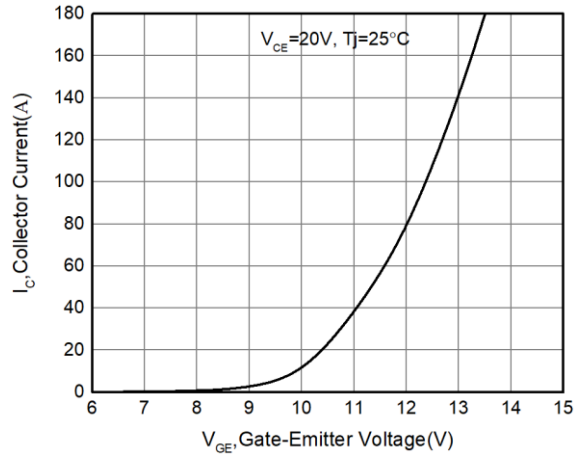


Figure 2. Typical transfer characteristic ($T_j = 25^\circ C$)

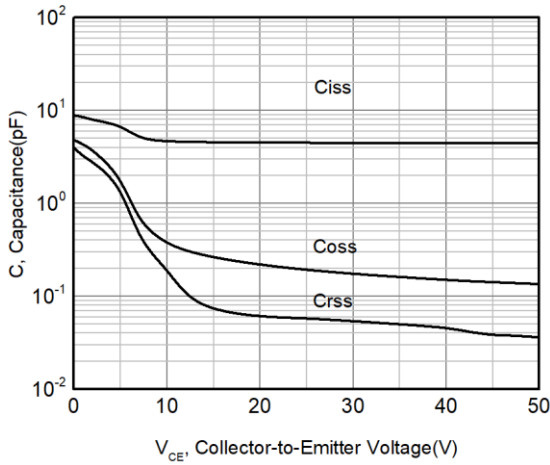


Figure 3. Capacitance characteristic ($V_{GE} = 0V, f = 1MHz$)

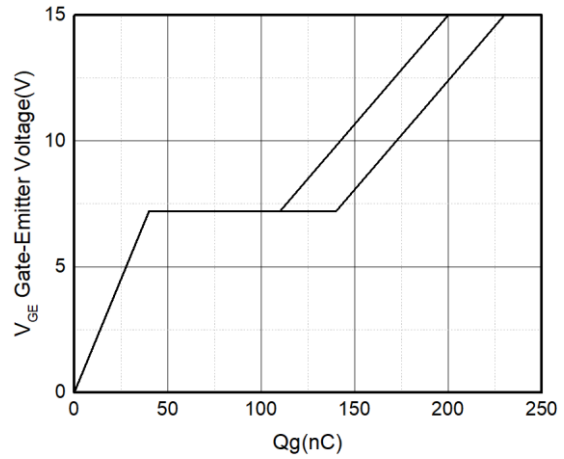


Figure 4. Typical gate charge ($I_C = 50A$)

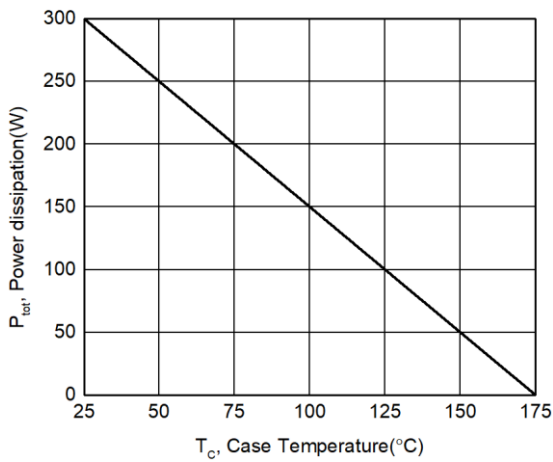


Figure 5. Power dissipation as a function of case temperature ($T_j \leq 175^\circ C$)

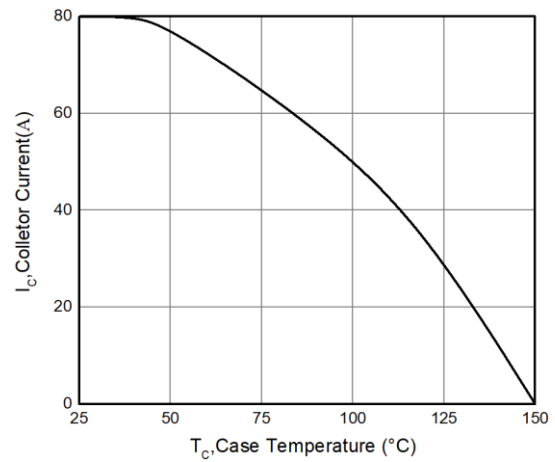


Figure 6. Collector current as a function of case temperature ($V_{GE} \geq 15V, T_j \leq 150^\circ C$)

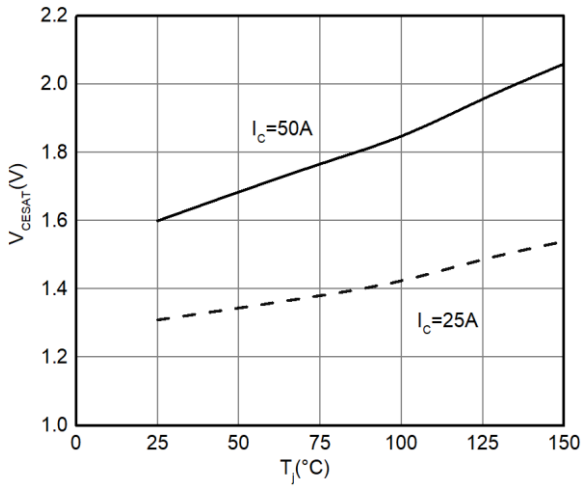


Figure 7. V_{CESAT} as a function of junction temperature ($V_{GE}=15V$)

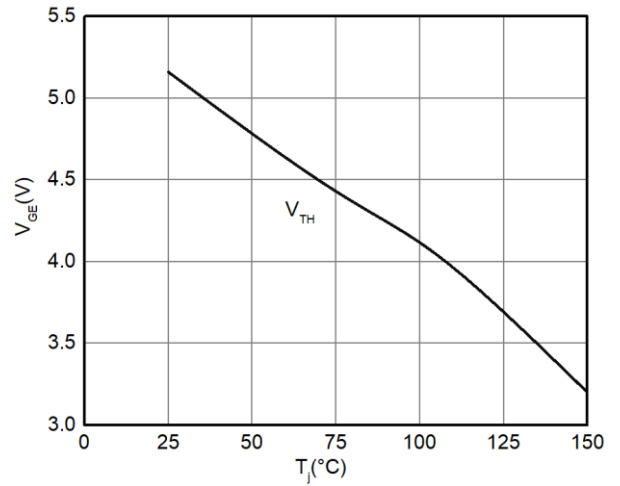


Figure 8. V_{TH} as a function of junction temperature ($I_{CE}=250\mu A$)

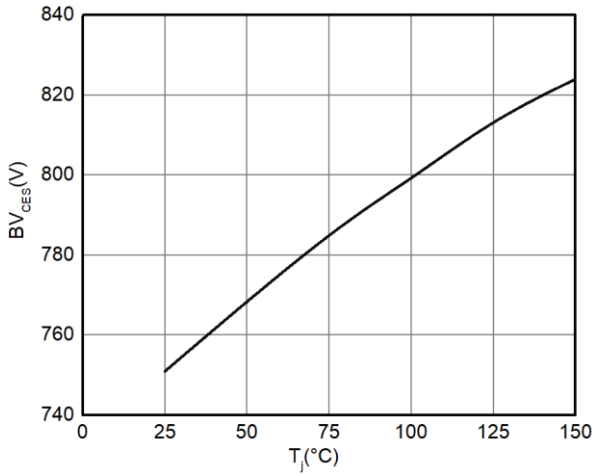


Figure 9. BV as a function of junction temperature ($I_{CE}=250\mu A$)

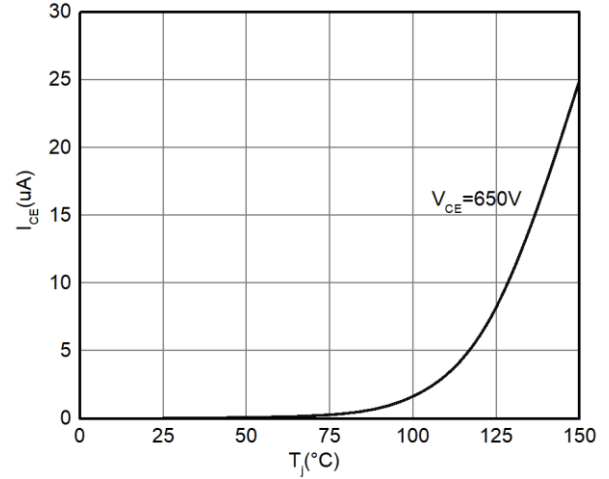


Figure 10. I_{CES} leakage current as a function of junction temperature

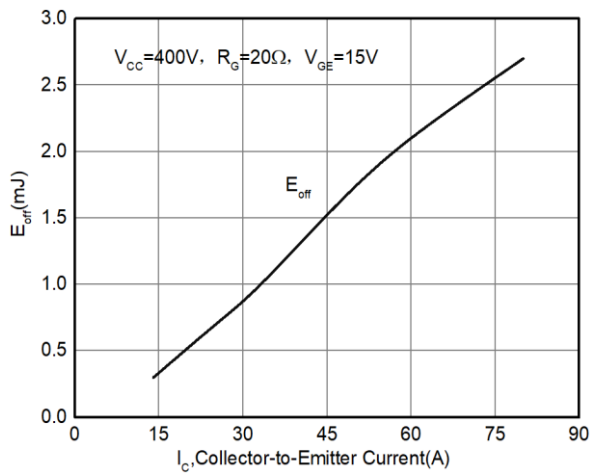


Figure 11. E_{off} as a function of I_C ($T_J=25^\circ C$)

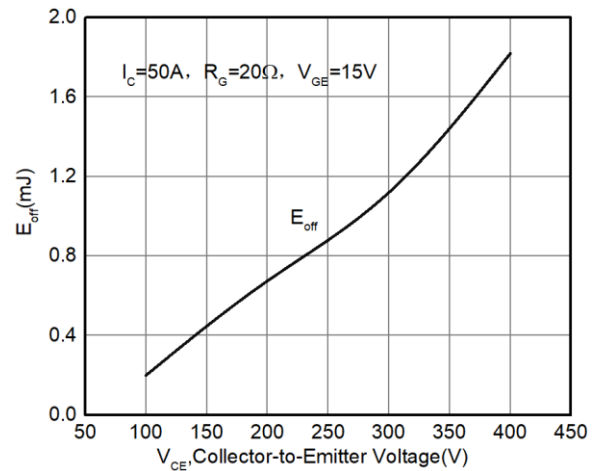


Figure 12. E_{off} as a function of V_{CE} ($T_J=25^\circ C$)

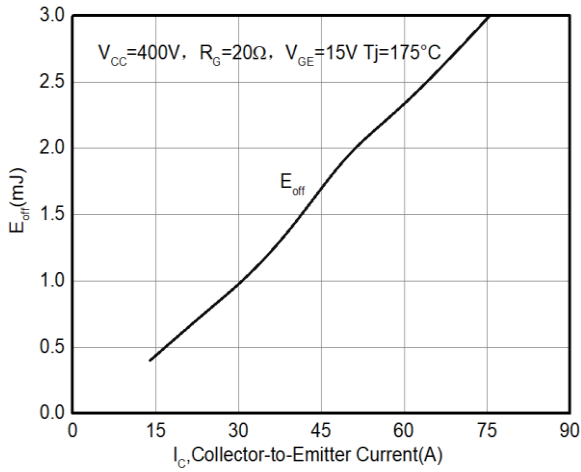


Figure 13. E_{off} as a function of I_C ($T_j=175^\circ C$)

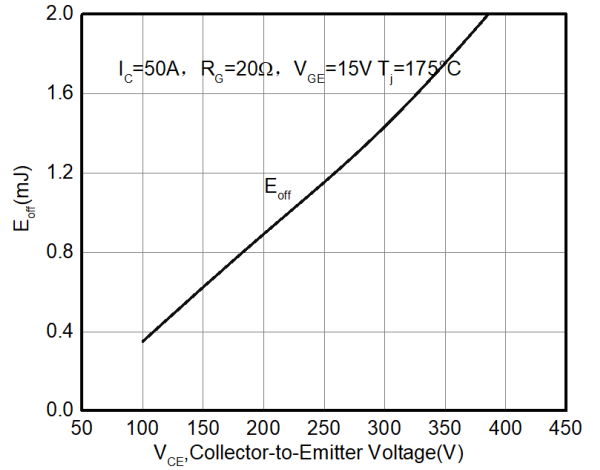


Figure 14. E_{off} as a function of V_{CE} ($T_j=175^\circ C$)

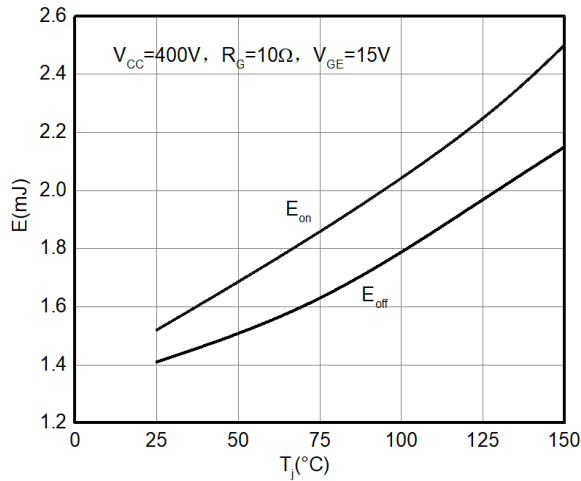


Figure 15. E_{on} & E_{off} as a function of junction temperature

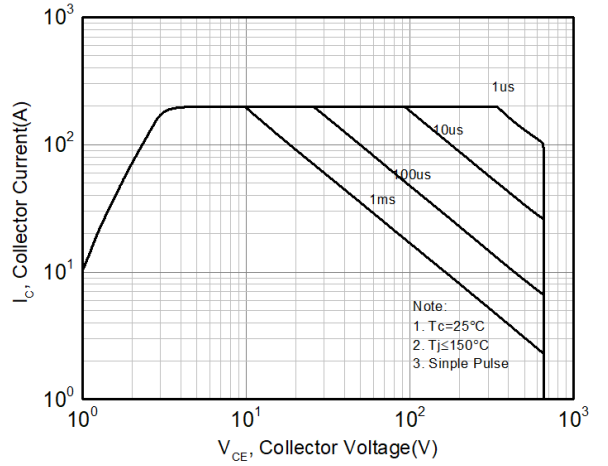
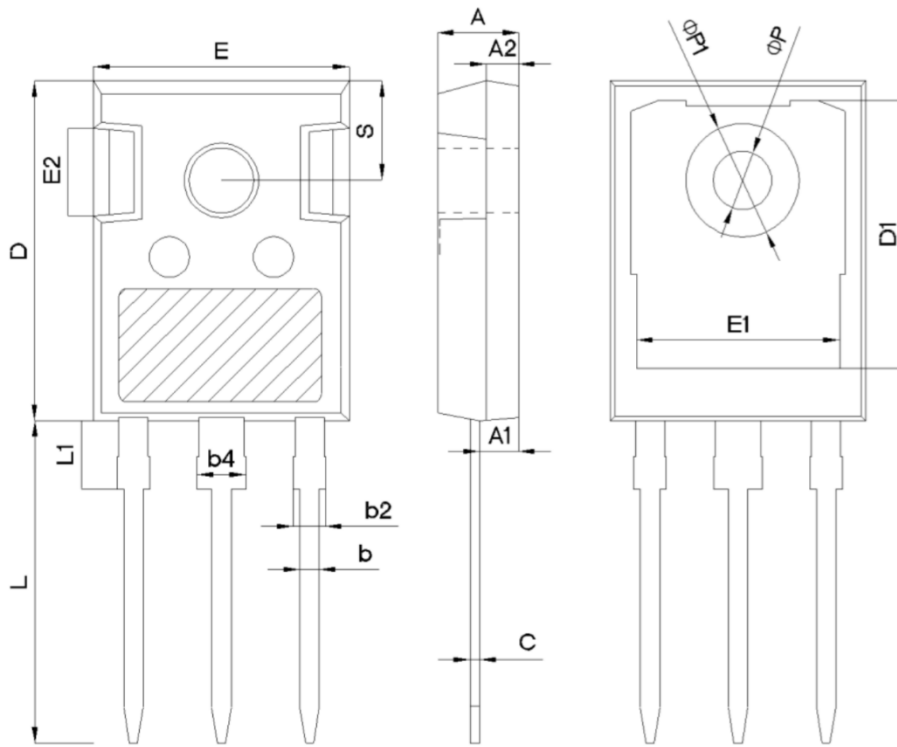


Figure 16. FBSOA

TO-247



| SYMBOL | mm | | |
|--------|---------|-------|-------|
| | MIN | NOM | MAX |
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.21 | 2.41 | 2.61 |
| A2 | 1.85 | 2.00 | 2.15 |
| b | 1.11 | 1.21 | 1.36 |
| b2 | 1.91 | 2.01 | 2.21 |
| b4 | 2.91 | 3.01 | 3.21 |
| c | 0.51 | 0.61 | 0.75 |
| D | 20.70 | 21.00 | 21.30 |
| D1 | 16.25 | 16.55 | 16.85 |
| E | 15.50 | 15.80 | 16.10 |
| E1 | 13.00 | 13.30 | 13.60 |
| E2 | 4.80 | 5.00 | 5.20 |
| E3 | 2.30 | 2.50 | 2.70 |
| e | 5.44BSC | | |
| L | 19.62 | 19.92 | 20.22 |
| L1 | - | - | 4.30 |
| ΦP | 3.40 | 3.60 | 3.80 |
| ΦP1 | - | - | 7.30 |
| S | 6.15BSC | | |



Revision: 2020-12-27, Rev. 1.0

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 1.0 | 2020-12-27 | |



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