

Integrated Power MOSFET with PNP Low $V_{CE(sat)}$ Switching Transistor

This integrated device represents a new level of safety and board-space reduction by combining the 20V P-Channel FET with a PNP Silicon Low $V_{CE(sat)}$ switching transistor. This newly integrated product provides higher efficiency and accuracy for battery powered portable electronics.

Features

- Low $R_{DS(on)}$ (MOSFET) and Low $V_{CE(sat)}$ (Transistor)
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive (MOSFET)
- Performance DFN Package
- This is a Halogen-Free Device

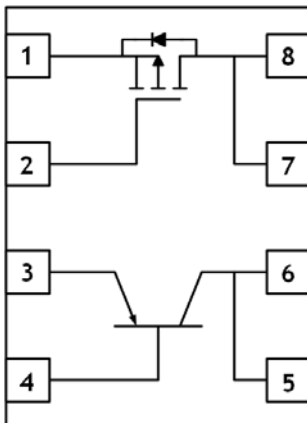
Applications

- Power Management in Portable and Battery-Powered Products; i.e., Cellular and Cordless Telephones and PCMCIA Cards

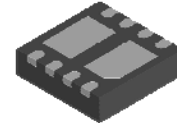
Ordering Information

| Device | Marking | Package |
|----------|---------|---------|
| SUM201MN | SUM201 | DFN8 |

Simple Schematic



DFN-8



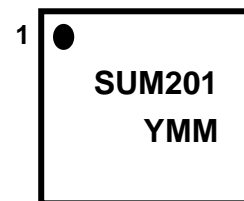
MOSFET

| BV_{DSS} | $R_{DS(ON)}$ Typ. | I_D Max |
|------------|----------------------------------|-----------|
| -20V | 48m Ω @ $V_{GS}=-4.5V$ | -5.3A |
| | 65m Ω @ $V_{GS}=-2.5V$ | |

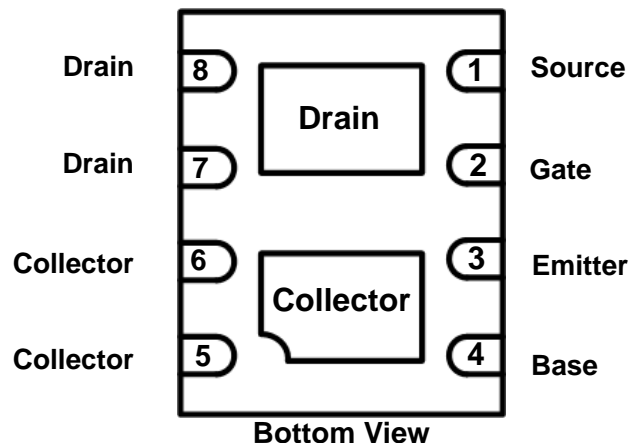
PNP BJT

| BV_{CEO} | BV_{EBO} | I_C Max |
|------------|------------|-----------|
| -20V | -5V | -5A |

Marking Diagram



Column 1 : Device Code
Column 2 : Date Code (year, month)



Absolute maximum ratings for P-Ch MOSFET

(Ta=25°C)

| Characteristic | Symbol | Rating | | Unit | |
|--|----------------|------------------------|--------------|------|---|
| | | 5sec | Steady State | | |
| Drain-source voltage | V_{DSS} | -20 | | V | |
| Gate-source voltage | V_{GSS} | ±12 | | V | |
| Drain current (DC) (Note.1) | I_D | $T_A=25^\circ\text{C}$ | -5.3 | -3.9 | A |
| | | $T_A=85^\circ\text{C}$ | -3.8 | -2.8 | A |
| Drain current (Pulsed) | I_{DP} | ±20 | | A | |
| Continuous Source current | I_S | -5.3 | -3.9 | A | |
| Total Power dissipation (Note.1) | P_D | $T_A=25^\circ\text{C}$ | 2.5 | 1.3 | W |
| | | $T_A=85^\circ\text{C}$ | 1.3 | 0.7 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 ~ 150 | | °C | |

Absolute maximum ratings for PNP Transistor

(Ta=25°C)

| Characteristic | Symbol | Rating | Unit |
|--------------------------------|-----------|--------|------|
| Collector-Base voltage | V_{CBO} | -35 | V |
| Collector-Emitter voltage | V_{CEO} | -20 | V |
| Emitter-Base voltage | V_{EBO} | -5 | V |
| Collector current – continuous | I_C | -5 | A |
| Peak Collector current | I_{CM} | -10 | A |

Thermal Characteristics for P-Ch MOSFET

| Characteristic | Symbol | Condition | Typ. | Max. | Unit |
|------------------------------|---------------|--------------|------|------|------|
| Junction to Ambient (Note.5) | $R_{TH(J-A)}$ | t≤5 sec | 40 | 50 | °C/W |
| | | Steady State | 80 | 95 | |
| Junction to Foot (Drain) | $R_{TH(J-F)}$ | Steady State | 15 | 20 | °C/W |

Thermal Characteristics for PNP Transistor

| Characteristic | Symbol | Max. | Unit |
|--|--------------------------|-----------|------|
| Total Device Dissipation | P_D (Note.2) | 635 | mW |
| Thermal Resistance, Junction to Ambient | $R_{TH(J-A)}$ (Note.2) | 200 | °C/W |
| Total Device Dissipation | P_D (Note.3) | 1.35 | W |
| Thermal Resistance, Junction to Ambient | $R_{TH(J-A)}$ (Note.3) | 90 | °C/W |
| Thermal Resistance, Junction to Lead #1 | $R_{TH(J-L)}$ | 15 | °C/W |
| Total Device Dissipation (Single Pulse < 10 sec) | $P_{Dsingle}$ (Note.3&4) | 2.75 | W |
| Junction and Storage Temperature Range | T_J, T_{stg} | -55 ~ 150 | °C |

1. Surface Mounted on FR4 Board using 1in square pad size (Cu area =1.27 in square [1 oz] including traces)

2. FR-4 @ 100 mm², 1 oz copper traces.

3. FR-4 @ 500 mm², 1 oz copper traces.

4. Thermal response.

Electrical Characteristics for P-Ch MOSFET

(Ta=25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|--|--------------|---|------|------|-----------|------------|
| Static | | | | | | |
| Drain-source breakdown voltage | BV_{DSS} | $I_D = -250\mu A, V_{GS} = 0$ | -20 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $I_D = -250\mu A, V_{DS} = V_{GS}$ | -0.6 | | -1.2 | V |
| Drain-source cut-off current | I_{DSS} | $V_{DS} = -20V, V_{GS} = 0V$ | - | - | -1 | μA |
| Gate leakage current | I_{GSS} | $V_{DS} = 0V, V_{GS} = \pm 12V$ | - | - | ± 100 | nA |
| On-State Drain Current ^(Note.6) | $I_{D(ON)}$ | $V_{DS} \leq -5.0V, V_{GS} = -4.5V$ | -20 | - | - | A |
| Drain-source on-resistance ^(Note.6) | $R_{DS(ON)}$ | $V_{GS} = -3.6V, I_D = -1.0A$ | - | 50 | 60 | m Ω |
| | | $V_{GS} = -2.5V, I_D = -1.0A$ | - | 70 | 83 | |
| Forward transfer conductance ^(Note.6) | g_{fs} | $V_{DS} = -10V, I_D = -3.9A$ | - | 12 | - | S |
| Diode Forward Voltage ^(Note.6) | V_{SD} | $I_S = -2.1A, V_{GS} = 0V$ | - | -0.8 | -1.2 | V |
| Dynamic ^(Note.7) | | | | | | |
| Input capacitance | C_{iss} | $V_{GS} = 0V, V_{DS} = -5V, f = 1MHz$ | - | 710 | - | pF |
| Output capacitance | C_{oss} | | - | 400 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 140 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = -10V, I_D = -1.0A, R_G = 6\Omega, R_D = 10\Omega, V_{GS} = -4.5V$ | - | 14 | 30 | ns |
| Rise time | t_r | | - | 22 | 55 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 42 | 100 | |
| Fall time | t_f | | - | 35 | 70 | |
| Total gate charge | Q_g | $V_{DD} = -10V, V_{GS} = -4.5V, I_D = -3.9A$ | - | 9.7 | 22 | nC |
| Gate-source charge | Q_{gs} | | - | 1.2 | - | |
| Gate-drain charge | Q_{gd} | | - | 3.6 | - | |

5. Surface Mounted on FR4 Board using 1 inch square pad size (Cu area =1.27 inch square [1 oz] including traces).

6. Pulse Test : Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.

7. Guaranteed by design, not subject to production testing.

Electrical Characteristics for PNP Transistor

(Ta=25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|--|---------------|------------------------------------|------|------|------|---------|
| Off Characteristics | | | | | | |
| Collector-Base breakdown voltage | BV_{CBO} | $I_C = -50\mu A, I_E = 0$ | -35 | - | - | V |
| Collector-Emitter breakdown voltage | BV_{CEO} | $I_C = -1mA, I_B = 0$ | -20 | - | - | V |
| Emitter-Base breakdown voltage | BV_{EBO} | $I_E = -50\mu A, I_C = 0$ | -5 | - | - | V |
| Collector cut-off current | I_{CBO} | $V_{CB} = -35V, I_E = 0$ | - | - | -1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = -5V, I_C = 0$ | - | - | -1 | μA |
| On Characteristics | | | | | | |
| DC current gain ^(Note.8) | h_{FE}^* | $V_{CE} = -2V, I_C = -500mA$ | 200 | - | 400 | - |
| Collector-Emitter saturation voltage ^(Note.8) | $V_{CE(sat)}$ | $I_C = -3A, I_B = -150mA$ | - | - | -0.5 | V |
| Transition frequency | f_T | $V_{CB} = -5V, I_C = -50mA$ | - | 180 | - | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = -10V, I_E = 0, f = 1MHz$ | - | 42 | - | pF |

8. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%.

Electrical Characteristic Curves (P-Channel MOSFET)

Fig. 1 $I_D - V_{DS}$

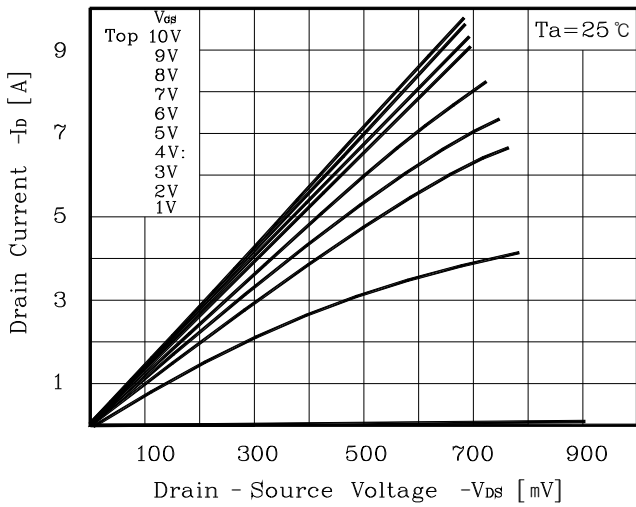


Fig. 2 $I_D - V_{GS}$

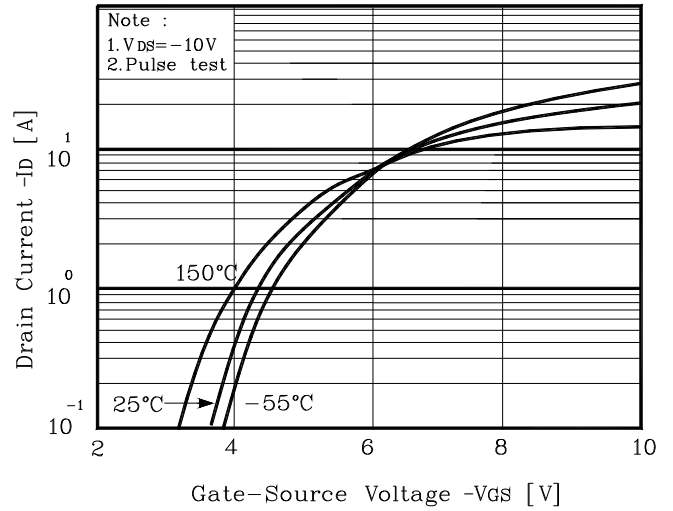


Fig. 3 $R_{DS(on)} - I_D$

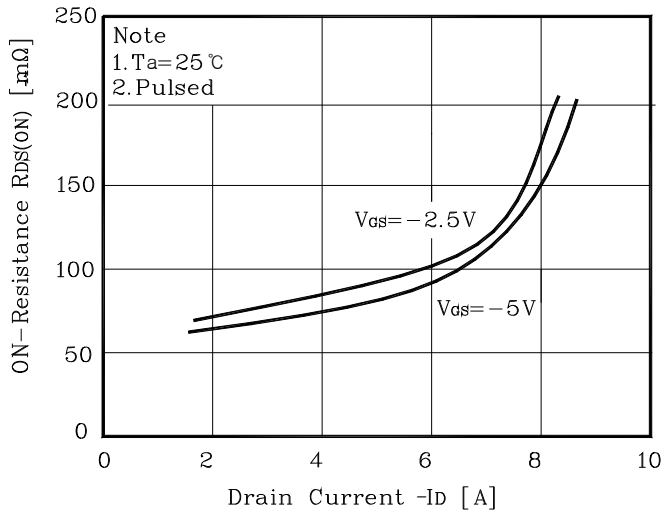


Fig. 4 $I_S - V_{SD}$

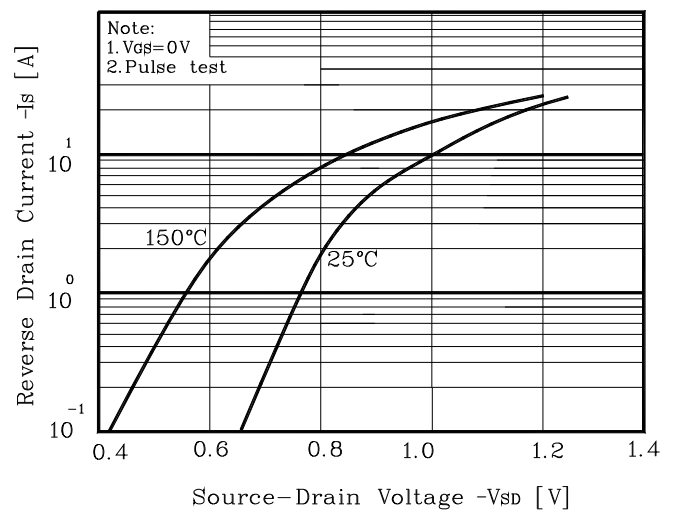


Fig. 5 Capacitance - V_{DS}

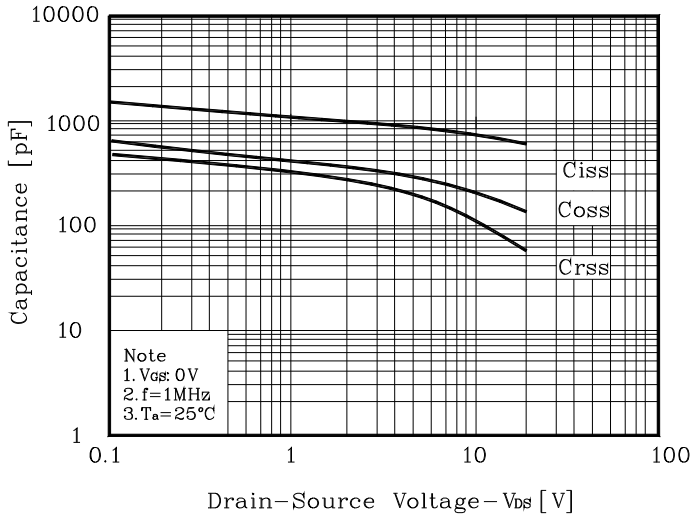
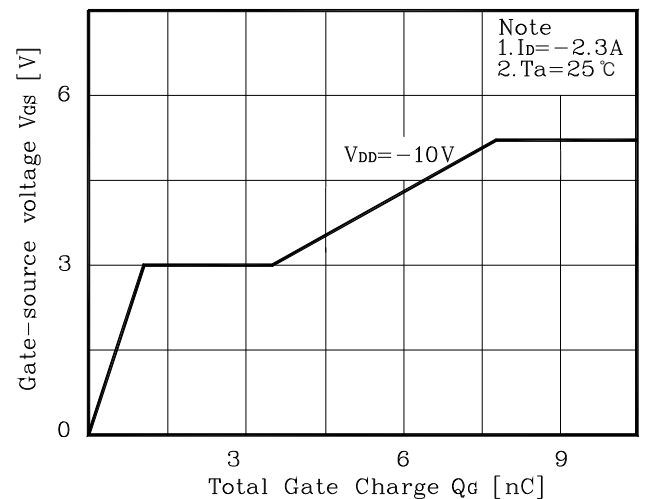


Fig. 6 $V_{GS} - Q_G$



Electrical Characteristics (P-Channel MOSFET)

Fig. 7 $V_{DSS} - T_J$

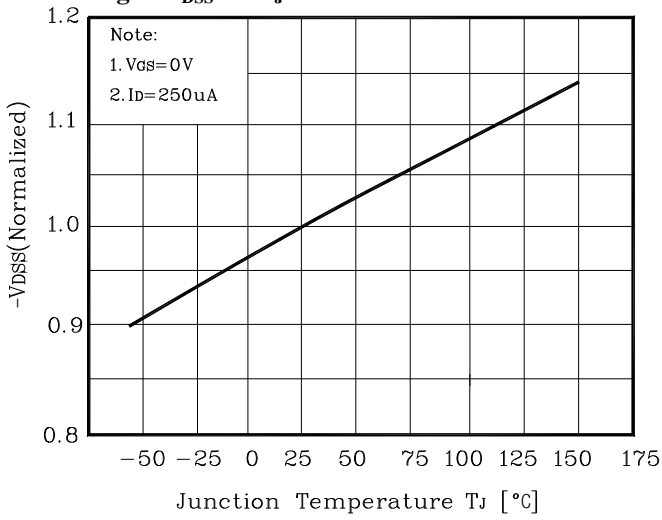


Fig. 8 $R_{DS(on)} - T_J$

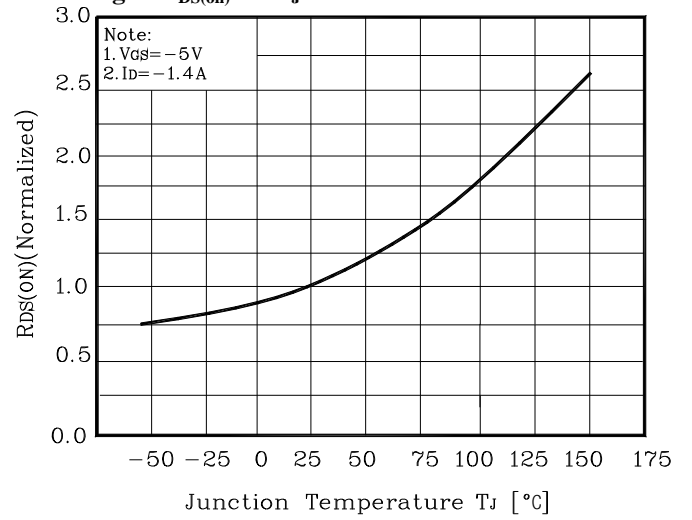
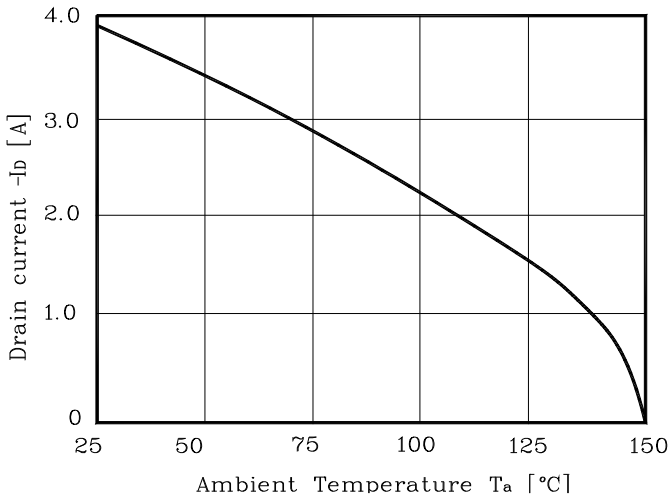


Fig. 9 $I_D - T_a$



Electrical Characteristic Curves (PNP BJT)

Fig. 1 $P_c - T_a$

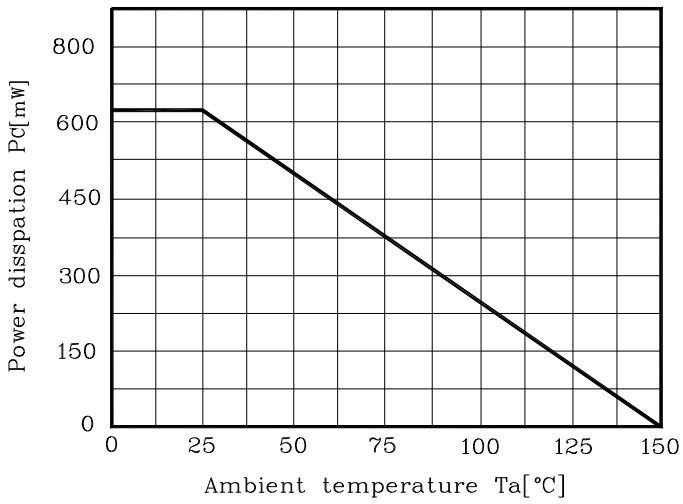


Fig. 2 $I_c - V_{BE}$

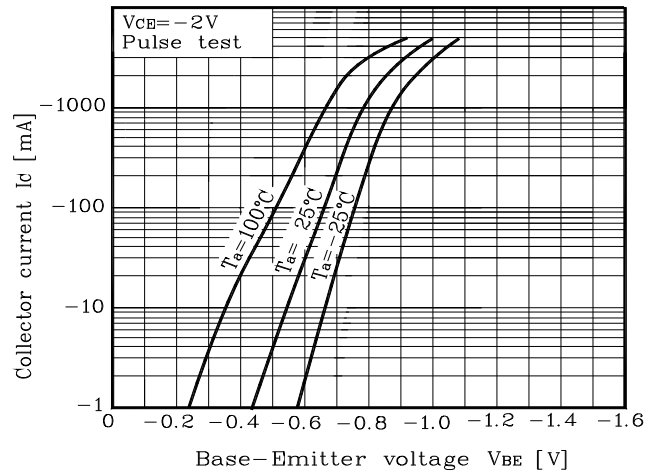


Fig. 3 $h_{FE} - I_c$

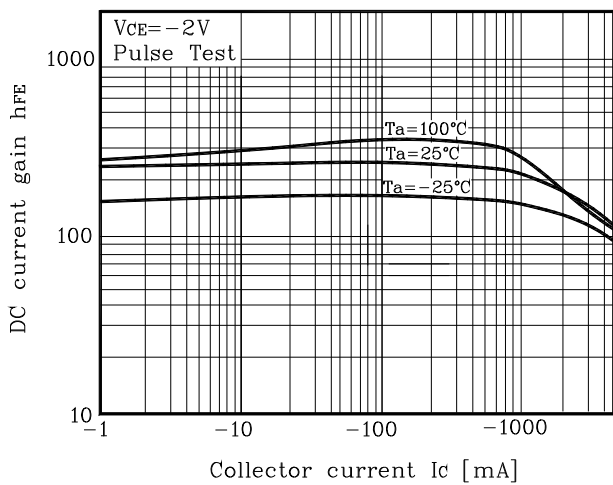


Fig. 4 $V_{CE(sat)} - I_c$

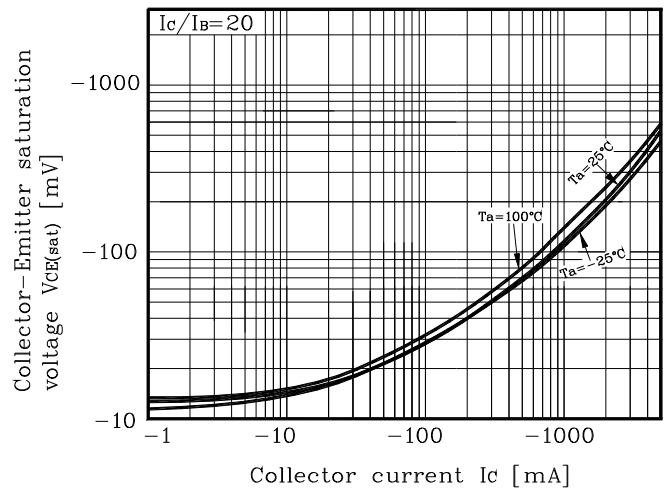
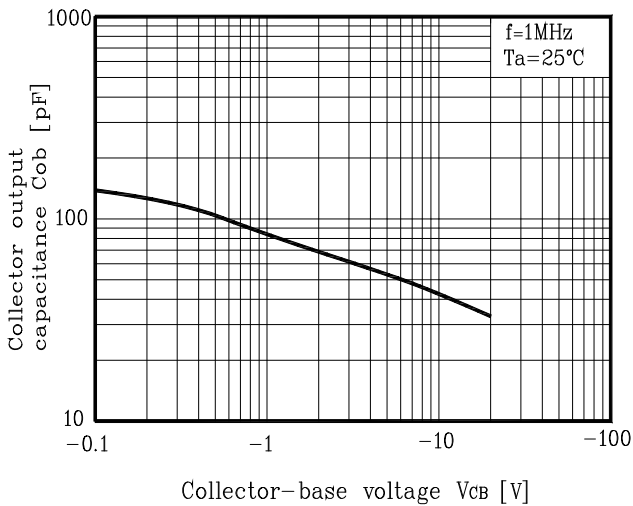
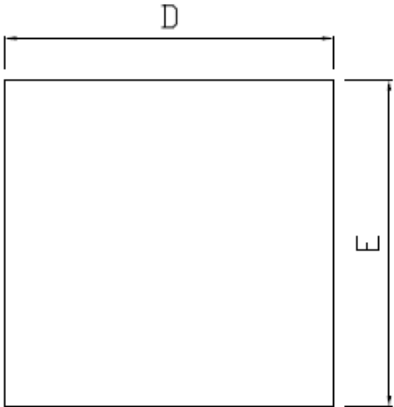


Fig. 5 $C_{ob} - V_{CB}$

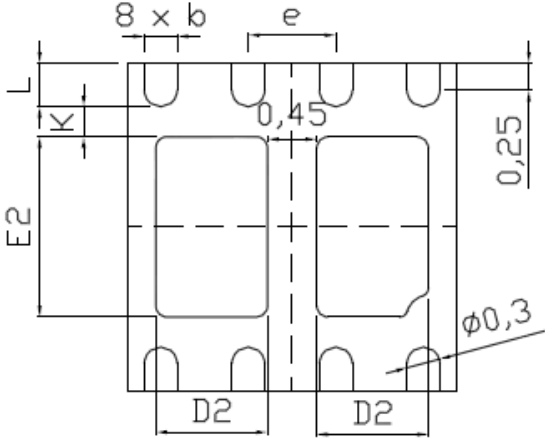


Outline Dimension

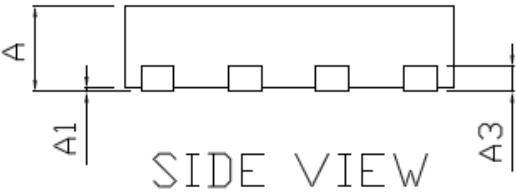
unit : mm



TOP VIEW



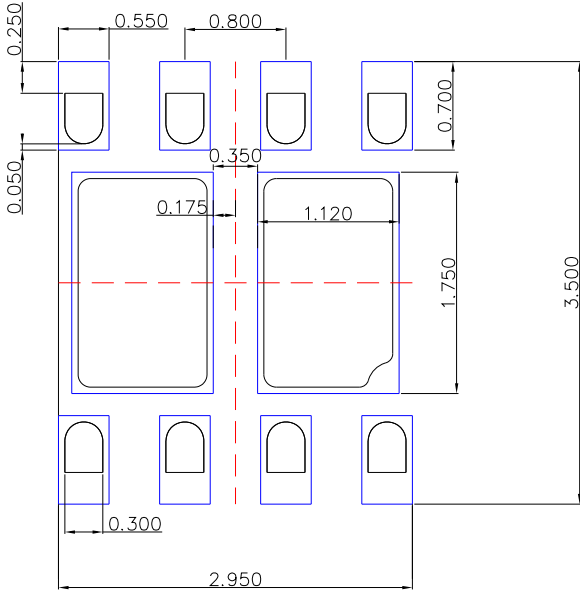
BOTTOM VIEW



SIDE VIEW

| DIMENSIONS(MM) | | | |
|----------------|------------|------|------|
| REF. | MIN. | NOM. | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.20 REF. | | |
| D | 2.95 | 3.00 | 3.05 |
| E | 2.95 | 3.00 | 3.05 |
| D2 | 0.87 | 1.02 | 1.12 |
| E2 | 1.50 | 1.65 | 1.75 |
| b | 0.25 | 0.30 | 0.35 |
| L | 0.30 | 0.40 | 0.50 |
| K | Min : 0.21 | | |
| e | 0.80 BSC | | |

※ Recommended Land Pattern [unit: mm]



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