



MG150PA120K1

1200V150A EconoPIM3 IGBT Module

IGBT, Inverter

Maximum Rated Values

|                                   |                                                                          |                     |        |   |
|-----------------------------------|--------------------------------------------------------------------------|---------------------|--------|---|
| Collector-emitter voltage         | $T_{vj} = 25^{\circ}\text{C}$                                            | $V_{CES}$           | 1200   | V |
| Continuous DC collector current   | $T_C = 100^{\circ}\text{C}$ , $T_{vj} \text{ max} = 150^{\circ}\text{C}$ | $I_{C \text{ nom}}$ | 150    | A |
| Repetitive peak collector current | $t_P = 1 \text{ ms}$                                                     | $I_{CRM}$           | 340    | A |
| Total power dissipation           | $T_C = 25^{\circ}\text{C}$ , $T_{vj} \text{ max} = 150$                  | $P_{tot}$           | 410    | W |
| Gate-emitter peak voltage         |                                                                          | $V_{GES}$           | +/- 20 | V |

| Characteristic value                 |                                                                                                          | min.                 |     | typ. | max. |               |
|--------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------|-----|------|------|---------------|
| Collector-emitter saturation voltage | $I_C = 150 \text{ A}$ , $V_{GE} = 15 \text{ V}$ $T_{vj} = 25^{\circ}\text{C}$                            | $V_{CE, \text{sat}}$ |     | 1.74 |      | V             |
|                                      | $I_C = 150 \text{ A}$ , $V_{GE} = 15 \text{ V}$ $T_{vj} = 125^{\circ}\text{C}$                           |                      |     |      |      | V             |
|                                      | $I_C = 150 \text{ A}$ , $V_{GE} = 15 \text{ V}$ $T_{vj} = 150^{\circ}\text{C}$                           |                      |     | 2.13 |      | V             |
| Gate threshold voltage               | $I_C = 2.8\text{mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25^{\circ}\text{C}$                                 | $V_{GE, \text{th}}$  | 5.0 | 6.0  | 6.5  | V             |
| Gate charge                          | $V_{GE} = -15 \text{ V} \dots +15 \text{ V}$                                                             | $Q_G$                |     |      |      | $\mu\text{C}$ |
| Internal gate resistor               | $T_{vj} = 25^{\circ}\text{C}$                                                                            | $R_{Gint}$           |     |      |      | $\Omega$      |
| Input capacitance                    | $f=1\text{MHz}$ , $T_{vj}=25^{\circ}\text{C}$ , $V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$                 | $C_{ies}$            |     |      |      | nF            |
| Reverse transfer capacitance         | $f=1\text{MHz}$ , $T_{vj}=25^{\circ}\text{C}$ , $V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$                 | $C_{res}$            |     |      |      | nF            |
| Collector-emitter cut-off current    | $V_{CE} = 1200 \text{ V}$ , $V_{GE} = 0 \text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$                       | $I_{CES}$            |     |      | 1    | mA            |
| Gate-emitter leakage current         | $V_{CE} = 0 \text{ V}$ , $V_{GE} = 20 \text{ V}$ , $T_{vj} = 25^{\circ}\text{C}$                         | $I_{GES}$            |     |      | 100  | nA            |
| Turn-on delay time, inductive load   | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ $T_{vj} = 25^{\circ}\text{C}$                               | $T_{d, \text{on}}$   |     | 0.32 |      | $\mu\text{s}$ |
|                                      | $V_{GE} = +15/-15\text{V}$ $T_{vj} = 125^{\circ}\text{C}$                                                |                      |     |      |      | $\mu\text{s}$ |
|                                      | $R_{G, \text{on}} = 15\Omega$ $T_{vj} = 150^{\circ}\text{C}$                                             |                      |     |      |      | $\mu\text{s}$ |
| Rise time, inductive load            | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ $T_{vj} = 25^{\circ}\text{C}$                               | $T_r$                |     | 0.09 |      | $\mu\text{s}$ |
|                                      | $V_{GE} = +15/-15\text{V}$ $T_{vj} = 125^{\circ}\text{C}$                                                |                      |     |      |      | $\mu\text{s}$ |
|                                      | $R_{G, \text{on}} = 15\Omega$ $T_{vj} = 150^{\circ}\text{C}$                                             |                      |     |      |      | $\mu\text{s}$ |
| Turn-off delay time, inductive load  | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ $T_{vj} = 25^{\circ}\text{C}$                               | $T_{d, \text{off}}$  |     | 0.65 |      | $\mu\text{s}$ |
|                                      | $V_{GE} = +15/-15\text{V}$ $T_{vj} = 125^{\circ}\text{C}$                                                |                      |     |      |      | $\mu\text{s}$ |
|                                      | $R_{G, \text{off}} = 15\Omega$ $T_{vj} = 150^{\circ}\text{C}$                                            |                      |     |      |      | $\mu\text{s}$ |
| Fall time, inductive load            | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ $T_{vj} = 25^{\circ}\text{C}$                               | $T_f$                |     | 1.1  |      | $\mu\text{s}$ |
|                                      | $V_{GE} = +15/-15\text{V}$ $T_{vj} = 125^{\circ}\text{C}$                                                |                      |     |      |      | $\mu\text{s}$ |
|                                      | $R_{G, \text{off}} = 15\Omega$ $T_{vj} = 150^{\circ}\text{C}$                                            |                      |     |      |      | $\mu\text{s}$ |
| Turn-on energy loss per pulse        | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ , $L_S \approx 35 \text{ nH}$ $T_{vj} = 25^{\circ}\text{C}$ | $E_{\text{on}}$      |     | 43.1 |      | mJ            |
|                                      | $V_{GE} = +15/-15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$                                              |                      |     |      |      | mJ            |
|                                      | $R_{G, \text{on}} = 15\Omega$ $T_{vj} = 150^{\circ}\text{C}$                                             |                      |     |      |      | mJ            |
| Turn-off energy loss per pulse       | $I_C = 150\text{A}$ , $V_{CE} = 600\text{V}$ , $L_S = 35\text{nH}$ $T_{vj} = 25^{\circ}\text{C}$         | $E_{\text{off}}$     |     | 23.0 |      | mJ            |
|                                      | $V_{GE} = +15/-15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$                                              |                      |     |      |      | mJ            |

|                                                                                   |              |
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|  | MG150PA120K1 |
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|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--|-----|------|--|-----|
|                                      | $R_{Goff} = 15\Omega$                                                                                                                                      | $T_{vj} = 150^{\circ}C$ |  |     |      |  | mJ  |
| SC data                              | $V_{GE} \leq 15V, V_{CE} = 600V, t_p \leq 8\mu s, T_{vj} = 25^{\circ}C, R_G = 10\Omega,$<br>$C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ | $I_{SC}$                |  | 740 |      |  | A   |
| Thermal resistance, junction to case | per IGBT, grease = 1.3 W/(m·K)                                                                                                                             | $R_{thJC}$              |  |     | 0.30 |  | K/W |

Diode, Inverter  
Maximum Rated Values

|                                 |                        |           |      |   |
|---------------------------------|------------------------|-----------|------|---|
| Repetitive peak reverse voltage | $T_{vj} = 25^{\circ}C$ | $V_{RRM}$ | 1200 | V |
| Continuous DC forward current   |                        | $I_F$     | 150  | A |
| Repetitive peak forward current | $t_p = 1\text{ ms}$    | $I_{FRM}$ | 300  | A |

Characteristic value

|                                      |                                           |                         | min.      | typ. | max. |                |
|--------------------------------------|-------------------------------------------|-------------------------|-----------|------|------|----------------|
| Forward voltage                      | $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 25^{\circ}C$  | $V_F$     | 2.06 |      | V              |
|                                      | $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 125^{\circ}C$ |           |      |      | V              |
|                                      | $I_F = 150\text{ A}, V_{GE} = 0\text{ V}$ | $T_{vj} = 150^{\circ}C$ |           | 1.78 |      | V              |
| Peak reverse recovery current        | $I_F = 150\text{ A}, V_R = 600\text{ V}$  | $T_{vj} = 25^{\circ}C$  | $I_{RM}$  | 145  |      | A              |
|                                      | $V_{GE} = -15\text{ V}$                   | $T_{vj} = 125^{\circ}C$ |           |      |      |                |
|                                      |                                           | $T_{vj} = 150^{\circ}C$ |           |      |      |                |
| Recovered charge                     | $I_F = 150\text{ A}, V_R = 600\text{ V}$  | $T_{vj} = 25^{\circ}C$  | $Q_r$     | 25.8 |      | $\mu\text{ C}$ |
|                                      | $V_{GE} = -15\text{ V}$                   | $T_{vj} = 125^{\circ}C$ |           |      |      |                |
|                                      |                                           | $T_{vj} = 150^{\circ}C$ |           |      |      |                |
| Reverse recovery energy              | $I_F = 150\text{ A}, V_R = 600\text{ V}$  | $T_{vj} = 25^{\circ}C$  | $E_{rec}$ | 5.8  |      | mJ             |
|                                      | $V_{GE} = -15\text{ V}$                   | $T_{vj} = 125^{\circ}C$ |           |      |      |                |
|                                      |                                           | $T_{vj} = 150^{\circ}C$ |           |      |      |                |
| Thermal resistance, junction to case | Per diode, grease = 1.3 W/(m·K)           | $R_{thJC}$              |           |      | 0.39 | K/W            |

Diode, Rectifier  
Maximum Rated Values

|                                  |                                             |           |      |     |
|----------------------------------|---------------------------------------------|-----------|------|-----|
| Repetitive peak reverse voltage  | $T_{vj} = 25^{\circ}C$                      | $V_{RRM}$ | 1600 | V   |
| Average Rectified Output current | $V_F = 1.2, T_{vj} = 150^{\circ}C$          | $I_F$     | 150  | A   |
| Surge forward current            | $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}C$ | $I_{FSM}$ | 1120 | A   |
| I²t - value                      | $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}C$ | $I^2t$    | 6272 | A²s |

Characteristic value

|                                      |                                              |            | min. | typ. | max. |     |
|--------------------------------------|----------------------------------------------|------------|------|------|------|-----|
| Forward voltage                      | $T_{vj} = 150^{\circ}C, I_F = 150\text{ A}$  | $V_F$      |      | 1.11 |      | V   |
| Reverse current                      | $T_{vj} = 150^{\circ}C, V_R = 1600\text{ V}$ | $I_R$      |      | 0.54 |      | mA  |
| Thermal resistance, junction to case | per Diode                                    | $R_{thJC}$ |      |      | 0.36 | K/W |
| Thermal resistance, junction to      | per Diode, $\lambda$ grease = 1.3 W/(m·K)    | $R_{thJH}$ |      |      |      | K/W |

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| heatsink |  |  |  |  |  |  |
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IGBT, Brake-Chopper  
Maximum Rated Values

|                                   |                                                         |            |        |   |
|-----------------------------------|---------------------------------------------------------|------------|--------|---|
| Collector-emitter voltage         | $T_{vj} = 25^{\circ}C$                                  | $V_{CES}$  | 1200   | V |
| Continuous DC collector current   | $T_C = 100^{\circ}C, T_{vj} \text{ max} = 150^{\circ}C$ | $I_{Cnom}$ | 100    | A |
| Repetitive peak collector current | $t_p = 1\text{ ms}$                                     | $I_{CRM}$  | 200    | A |
| Total power dissipation           | $T_C = 25^{\circ}C, T_{vj} \text{ max} = 150$           | $P_{tot}$  | 410    | W |
| Gate-emitter peak voltage         |                                                         | $V_{GES}$  | +/- 20 | V |

Characteristic value

|                                      |                                                                                     |                         | min.         | typ.   | max. |                |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------|--------------|--------|------|----------------|
| Collector-emitter saturation voltage | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                          | $T_{vj} = 25^{\circ}C$  | $V_{CE,sat}$ | 2.15   |      | V              |
|                                      | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                          | $T_{vj} = 125^{\circ}C$ |              | 2.27   |      | V              |
|                                      | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                          | $T_{vj} = 150^{\circ}C$ |              | 2.29   |      | V              |
| Gate threshold voltage               | $I_C = 5.7\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}C$                        | $V_{GE,th}$             | 5.0          | 5.8    | 6.5  | V              |
| Gate charge                          | $V_{GE} = -15\text{ V} \dots +15\text{ V}$                                          | $Q_G$                   |              | 1.73   |      | $\mu\text{ C}$ |
| Internal gate resistor               | $T_{vj} = 25^{\circ}C$                                                              | $R_{Gint}$              |              | 2.1    |      | $\Omega$       |
| Input capacitance                    | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}C, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | $C_{ies}$               |              | 21.59  |      | nF             |
| Reverse transfer capacitance         | $f = 1\text{ MHz}, T_{vj} = 25^{\circ}C, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | $C_{res}$               |              | 0.165  |      | nF             |
| Collector-emitter cut-off current    | $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}C$                 | $I_{CES}$               |              |        | 1    | mA             |
| Gate-emitter leakage current         | $V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}C$                   | $I_{GES}$               |              |        | 100  | nA             |
| Turn-on delay time, inductive load   | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$                                         | $T_{vj} = 25^{\circ}C$  | $T_{d,on}$   | 0.298  |      | us             |
|                                      | $V_{GE} = +15/-15\text{ V}$                                                         | $T_{vj} = 125^{\circ}C$ |              | 0.2753 |      | us             |
|                                      | $R_{G,on} = 15\Omega$                                                               | $T_{vj} = 150^{\circ}C$ |              |        |      | us             |
| Rise time, inductive load            | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$                                         | $T_{vj} = 25^{\circ}C$  | $T_r$        | 0.077  |      | us             |
|                                      | $V_{GE} = +15/-15\text{ V}$                                                         | $T_{vj} = 125^{\circ}C$ |              | 0.094  |      | us             |
|                                      | $R_{G,on} = 15\Omega$                                                               | $T_{vj} = 150^{\circ}C$ |              |        |      | us             |
| Turn-off delay time, inductive load  | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$                                         | $T_{vj} = 25^{\circ}C$  | $T_{d,off}$  | 0.505  |      | us             |
|                                      | $V_{GE} = +15/-15\text{ V}$                                                         | $T_{vj} = 125^{\circ}C$ |              | 0.559  |      | us             |
|                                      | $R_{Goff} = 15\Omega$                                                               | $T_{vj} = 150^{\circ}C$ |              |        |      | us             |
| Fall time, inductive load            | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}$                                         | $T_{vj} = 25^{\circ}C$  | $T_f$        | 0.124  |      | us             |
|                                      | $V_{GE} = +15/-15\text{ V}$                                                         | $T_{vj} = 125^{\circ}C$ |              | 0.339  |      | us             |
|                                      | $R_{Goff} = 15\Omega$                                                               | $T_{vj} = 150^{\circ}C$ |              |        |      | us             |
| Turn-on energy loss per pulse        | $I_C = 100\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$                     | $T_{vj} = 25^{\circ}C$  | $E_{on}$     | 16.49  |      | mJ             |
|                                      | $V_{GE} = +15/-15\text{ V},$                                                        | $T_{vj} = 125^{\circ}C$ |              |        |      | mJ             |
|                                      | $R_{Gon} = 15\Omega$                                                                | $T_{vj} = 150^{\circ}C$ |              |        |      | mJ             |

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|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--|-------|------|-----|
| Turn-off energy loss per pulse       | $I_C = 100A, V_{CE} = 600V, L_S = 35nH \quad T_{vj} = 25^{\circ}C$                                                                                   | $E_{off}$   |  | 15.59 |      | mJ  |
|                                      | $V_{GE} = +15/-15V, \quad T_{vj} = 125^{\circ}C$                                                                                                     |             |  | 20.71 |      | mJ  |
|                                      | $R_{Goff} = 15\Omega \quad T_{vj} = 150^{\circ}C$                                                                                                    |             |  |       |      | mJ  |
| SC data                              | $V_{GE} \leq 15V, V_{CC} = 600V, t_p \leq 8\mu s, T_{vj} = 25^{\circ}C, R_G = 10\Omega, C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{SC} \cdot di/dt$ | $I_{SC}$    |  | 520   |      | A   |
| Thermal resistance, junction to case | per IGBT, grease = 1.3 W/(m·K)                                                                                                                       | $R_{th,JC}$ |  |       | 0.30 | K/W |

Diode, Brake-Chopper  
Maximum Rated Values

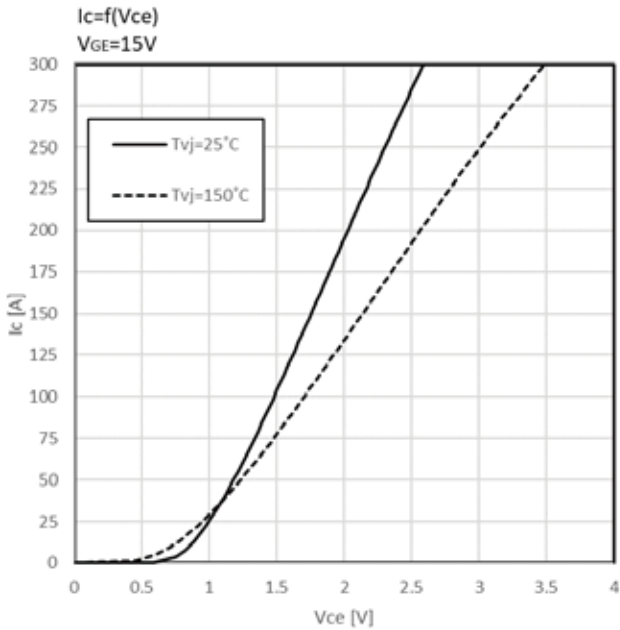
|                                      |                                                       |             |  |      |       |         |
|--------------------------------------|-------------------------------------------------------|-------------|--|------|-------|---------|
| Repetitive peak reverse voltage      | $T_{vj} = 25^{\circ}C$                                | $V_{RRM}$   |  | 1200 |       | V       |
| Continuous DC forward current        |                                                       | $I_F$       |  | 100  |       | A       |
| Repetitive peak forward current      | $t_p = 1\text{ ms}$                                   | $I_{FRM}$   |  | 200  |       | A       |
| Characteristic value                 |                                                       |             |  |      |       |         |
| Forward voltage                      | $I_F = 100A, V_{GE} = 0V \quad T_{vj} = 25^{\circ}C$  | $V_F$       |  | 2.00 |       | V       |
|                                      | $I_F = 100A, V_{GE} = 0V \quad T_{vj} = 125^{\circ}C$ |             |  |      |       | V       |
|                                      | $I_F = 100A, V_{GE} = 0V \quad T_{vj} = 150^{\circ}C$ |             |  | 1.75 |       | V       |
| Peak reverse recovery current        | $I_F = 100A, V_R = 600V \quad T_{vj} = 25^{\circ}C$   | $I_{RM}$    |  | 98   |       | A       |
|                                      | $V_{GE} = -15V \quad T_{vj} = 125^{\circ}C$           |             |  |      |       |         |
|                                      | $T_{vj} = 150^{\circ}C$                               |             |  |      |       |         |
| Recovered charge                     | $I_F = 100A, V_R = 600V \quad T_{vj} = 25^{\circ}C$   | $Q_r$       |  | 26.4 |       | $\mu C$ |
|                                      | $V_{GE} = -15V \quad T_{vj} = 125^{\circ}C$           |             |  |      |       |         |
|                                      | $T_{vj} = 150^{\circ}C$                               |             |  |      |       |         |
| Reverse recovery energy              | $I_F = 100A, V_R = 600V \quad T_{vj} = 25^{\circ}C$   | $E_{rec}$   |  | 9.4  |       | mJ      |
|                                      | $V_{GE} = -15V \quad T_{vj} = 125^{\circ}C$           |             |  |      |       |         |
|                                      | $T_{vj} = 150^{\circ}C$                               |             |  |      |       |         |
| Thermal resistance, junction to case | Per diode, grease = 1.3 W/(m·K)                       | $R_{th,JC}$ |  |      | 0.465 | K/W     |

NTC-Thermistor  
Characteristic value

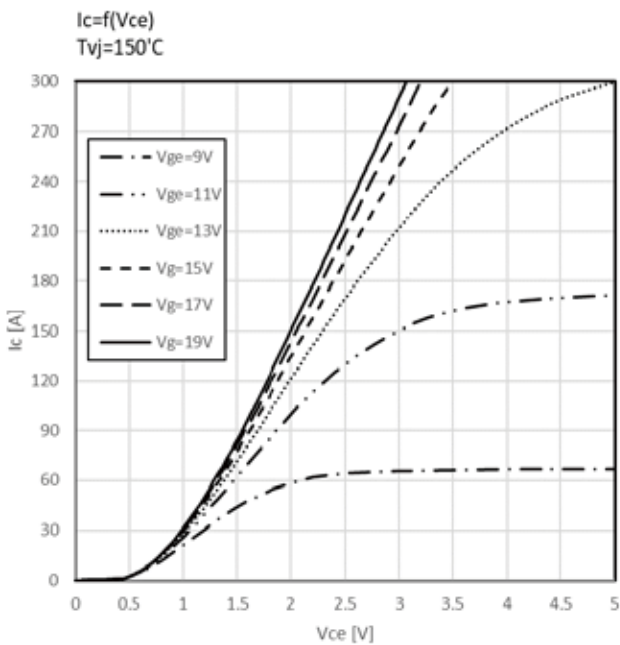
|                      |                                                       |                  |  |        |     |            |
|----------------------|-------------------------------------------------------|------------------|--|--------|-----|------------|
| Characteristic value |                                                       |                  |  |        |     |            |
| Rated resistance     | $T_c = 25^{\circ}C$                                   | $R_{25}$         |  | 5.07   |     | K $\Omega$ |
| Power dissipation    | $T_c = 25^{\circ}C$                                   | $P_{25}$         |  |        | 240 | mW         |
| B-value              | $R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$  | $B_{25}/B_{50}$  |  | 3412.7 |     | K          |
| B-value              | $R_2 = R_{25} \exp[B_{25/75}(1/T_2 - 1/(298, 15K))]$  | $B_{25}/B_{75}$  |  | 3454.8 |     | K          |
| B-value              | $R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298, 15K))]$ | $B_{25}/B_{100}$ |  | 3442.2 |     | K          |

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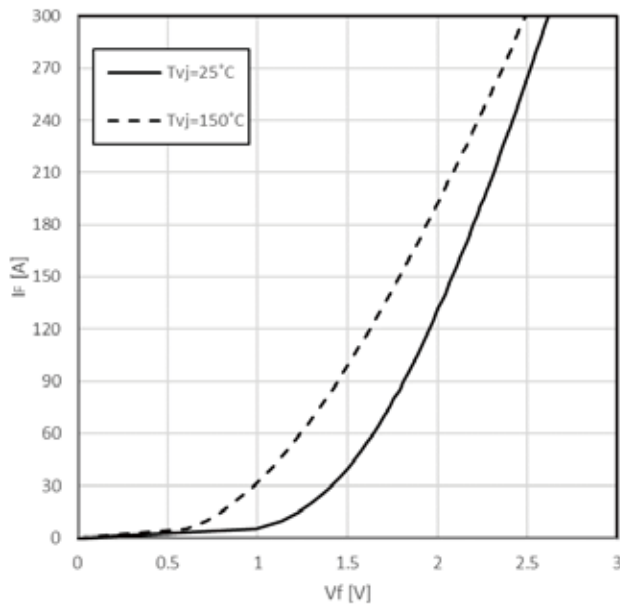
Output characteristic IGBT, Inverter (typical)



Output characteristic IGBT, Inverter (typical)



Forward characteristic of Diode, Inverter (typical)  
 $I_F = f(V_F)$



Forward characteristic of Diode, Rectifier (typical)  
 $I_F = f(V_F)$

