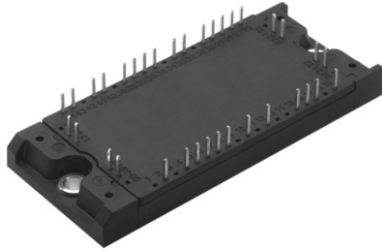


## IGBT Fourpack Module, 75 A


**ECONO2 4PACK**

### FEATURES

- Square RBSOA
- HEXFRED® low  $Q_{rr}$ , low switching energy
- Positive  $V_{CE(on)}$  temperature coefficient
- Copper baseplate
- Low stray inductance design
- Speed 8 to 60 kHz
- Designed and qualified for industrial market


**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

|                               |        |
|-------------------------------|--------|
| $V_{CES}$                     | 1200 V |
| $I_C$ at $T_C = 67\text{ °C}$ | 75 A   |
| $V_{CE(on)}$ (typical)        | 3.4 V  |

### BENEFITS

- Benchmark efficiency for SMPS application in particular HF welding
- Rugged transient performance
- Low EMI, requires less snubbing
- Direct mounting to heatsink space saving
- PCB solderable terminals
- Low junction to case thermal resistance

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                  | SYMBOL     | TEST CONDITIONS      | MAX.          | UNITS |
|--|------------|----------------------|---------------|-------|
| Collector to emitter voltage               | $V_{CES}$  |                      | 1200          | V     |
| Continuous collector current               | $I_C$      | $T_C = 25\text{ °C}$ | 100           | A     |
|  |            | $T_C = 80\text{ °C}$ | 67            |       |
| Pulsed collector current<br>See fig. C.T.5 | $I_{CM}$   |                      | 200           |       |
| Clamped inductive load current             | $I_{LM}$   |                      | 200           |       |
| Diode continuous forward current           | $I_F$      | $T_C = 25\text{ °C}$ | 40            |       |
|  |            | $T_C = 80\text{ °C}$ | 25            |       |
| Diode maximum forward current              | $I_{FM}$   |                      | 150           |       |
| Gate to emitter voltage                    | $V_{GE}$   |                      | $\pm 20$      | V     |
| Maximum power dissipation (IGBT)           | $P_D$      | $T_C = 25\text{ °C}$ | 480           | W     |
|  |            | $T_C = 80\text{ °C}$ | 270           |       |
| Maximum operating junction temperature     | $T_J$      |                      | 150           | °C    |
| Storage temperature range                  | $T_{Stg}$  |                      | - 40 to + 125 |       |
| Isolation voltage                          | $V_{ISOL}$ |                      | AC 2500 (MIN) | V     |

| <b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified) |                                |  |      |      |           |               |
|---|--------------------------------|--|------|------|-----------|---------------|
| PARAMETER   | SYMBOL                         | TEST CONDITIONS  | MIN. | TYP. | MAX.      | UNITS         |
| Collector to emitter breakdown voltage  | $V_{BR(CE)}$                   | $V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$                            | 1200 | -    | -         | V             |
| Collector to emitter voltage  | $V_{CE(ON)}$                   | $I_C = 75\text{ A}, V_{GE} = 15\text{ V}$                                      | -    | 3.4  | 4.0       |               |
|   |                                | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$                                     | -    | 3.8  | 4.5       |               |
|   |                                | $I_C = 75\text{ A}, V_{GE} = 15\text{ V}, T_J = 125\text{ }^\circ\text{C}$     | -    | 4.0  | 4.5       |               |
|   |                                | $I_C = 100\text{ A}, V_{GE} = 15\text{ V}, T_J = 125\text{ }^\circ\text{C}$    | -    | 4.53 | 5.1       |               |
| Gate threshold voltage  | $V_{GE(th)}$                   | $V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$                                | 4.0  | 5.0  | 6.0       |               |
| Threshold voltage temperature coefficient   | $\Delta V_{GE(th)}/\Delta T_J$ | $V_{CE} = V_{GE}, I_C = 1\text{ mA}$ (25 °C to 125 °C)                         | -    | - 11 | -         | mV/°C         |
| Zero gate voltage collector current   | $I_{CES}$                      | $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$                                  | -    | 7    | 250       | $\mu\text{A}$ |
|   |                                | $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | -    | 580  | 2000      |               |
| Diode forward voltage drop  | $V_{FM}$                       | $I_F = 75\text{ A}$  | -    | 3.9  | 5.0       | V             |
|   |                                | $I_F = 100\text{ A}$   | -    | 4.43 | 5.8       |               |
|   |                                | $I_F = 75\text{ A}, T_J = 125\text{ }^\circ\text{C}$                           | -    | 4.37 | 5.4       |               |
|   |                                | $I_F = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$                          | -    | 5.02 | 6.4       |               |
| Gate to emitter leakage current   | $I_{GES}$                      | $V_{GE} = \pm 20\text{ V}$   | -    | -    | $\pm 200$ | nA            |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted) |              |  |  |            |      |               |
|---|--------------|--|--|------------|------|---------------|
| PARAMETER   | SYMBOL       | TEST CONDITIONS  | MIN.   | TYP.       | MAX. | UNITS         |
| Total gate charge (turn-on)   | $Q_G$        | $I_C = 500\text{ A}$<br>$V_{CC} = 600\text{ V}$<br>$V_{GE} = 15\text{ V}$  | -  | 630        | -    | nC            |
| Gate to emitter charge (turn-on)  | $Q_{GE}$     |  | -  | 65         | -    |               |
| Gate to collector charge (turn-on)  | $Q_{GC}$     |  | -  | 250        | -    |               |
| Turn-on switching loss  | $E_{on}$     | $I_C = 50\text{ A}, V_{CC} = 600\text{ V}$<br>$V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$<br>$T_J = 25\text{ }^\circ\text{C}$ (1)  | -  | 1.51       | -    | mJ            |
| Turn-off switching loss   | $E_{off}$    |  | -  | 2.41       | -    |               |
| Total switching loss  | $E_{tot}$    |  | -  | 3.92       | -    |               |
| Turn-on switching loss  | $E_{on}$     |  | -  | 2.25       | -    |               |
| Turn-off switching loss   | $E_{off}$    | $I_C = 50\text{ A}, V_{CC} = 600\text{ V}$<br>$V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$<br>$T_J = 125\text{ }^\circ\text{C}$ (1) | -  | 3.35       | -    | mJ            |
| Turn-off switching loss   | $E_{off}$    |  | -  | 3.35       | -    |               |
| Total switching loss  | $E_{tot}$    |  | -  | 7.60       | -    |               |
| Turn-on delay time  | $t_{d(on)}$  |  | -  | 169        | -    |               |
| Rise time   | $t_r$        | $I_C = 50\text{ A}, V_{CC} = 600\text{ V}$<br>$V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$<br>$T_J = 125\text{ }^\circ\text{C}$     | -  | 71         | -    | ns            |
| Turn-off delay time   | $t_{d(off)}$ |  | -  | 393        | -    |               |
| Fall time   | $t_f$        |  | -  | 136        | -    |               |
| Reverse bias safe operating area  | RBSOA        |  | $T_J = 150\text{ }^\circ\text{C}, I_C = 150\text{ A}$<br>$R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}$ | Fullsquare |      |               |
| Short circuit safe operating area   | SCSOA        | $T_J = 150\text{ }^\circ\text{C}$<br>$V_{CC} = 900\text{ V}, V_P = 1200\text{ V}$<br>$R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}$                 | 10   | -          | -    | $\mu\text{s}$ |
| Diode peak reverse recovery current   | $I_{rr}$     | $T_J = 25\text{ }^\circ\text{C}$   | -  | 1.45       | 2.5  | A             |
|   |              | $T_J = 125\text{ }^\circ\text{C}$  | -  | 2.35       | 4.0  |               |
| Diode reverse recovery time   | $t_{rr}$     | $T_J = 25\text{ }^\circ\text{C}$   | -  | 0.401      | 0.5  | $\mu\text{s}$ |
|   |              | $T_J = 125\text{ }^\circ\text{C}$  | -  | 0.655      | 0.8  |               |
| Total reverse recovery charge   | $Q_{rr}$     | $T_J = 25\text{ }^\circ\text{C}$   | -  | 0.181      | 0.4  | $\mu\text{C}$ |
|   |              | $T_J = 125\text{ }^\circ\text{C}$  | -  | 0.54       | 1.5  |               |

**Note**

(1) Energy losses include "tail" and diode reverse recovery

| THERMAL AND MECHANICAL SPECIFICATIONS |                     |      |      |      |       |
|---------------------------------------|---------------------|------|------|------|-------|
| PARAMETER                             | SYMBOL              | MIN. | TYP. | MAX. | UNITS |
| Junction to case IGBT                 | $R_{thJC}$ (IGBT)   | -    | -    | 0.26 | °C/W  |
| Junction to case DIODE                | $R_{thJC}$ (DIODE)  | -    | -    | 1.00 |       |
| Case to sink, flat, greased surface   | $R_{thCS}$ (MODULE) | -    | 0.05 | -    |       |
| Mounting torque (M5)                  |                     | 2.7  | -    | 3.3  | Nm    |
| Weight                                |                     | -    | 170  | -    | g     |

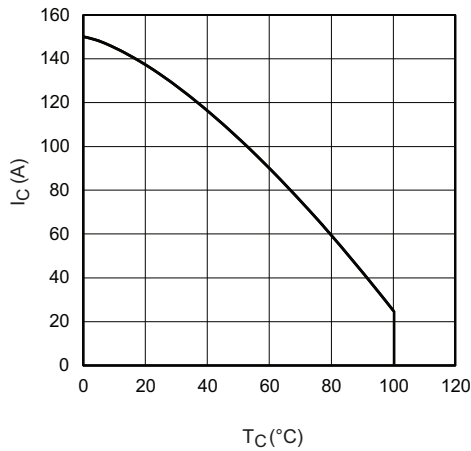


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

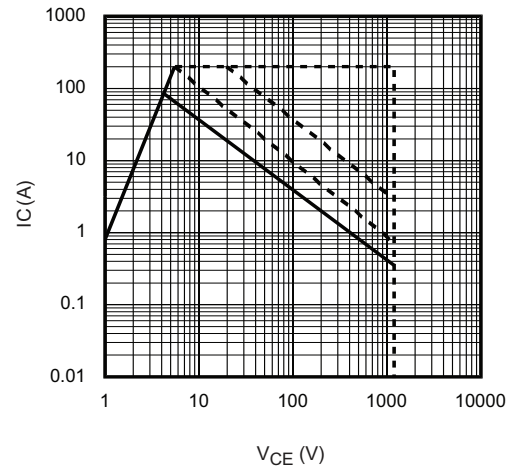
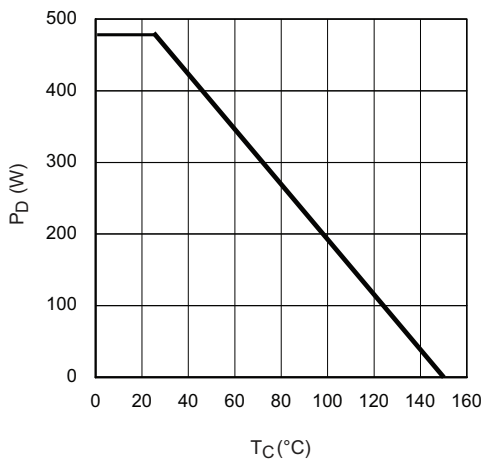
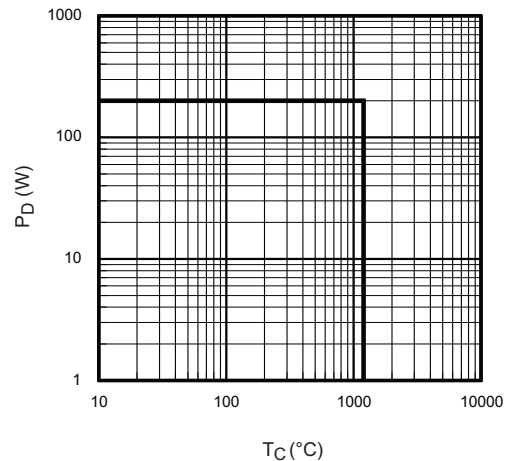

 Fig. 3 - Forward SOA  
 $T_C = 25\text{ °C}$ ;  $T_J \leq 150\text{ °C}$ 


Fig. 2 - Power Dissipation vs. Case Temperature


 Fig. 4 - Reverse Bias SOA  
 $T_J = 150\text{ °C}$ ;  $V_{GE} = 15\text{ V}$

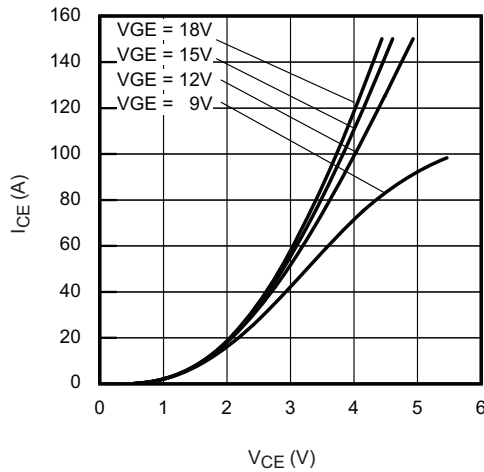


Fig. 5 - Typical IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 500 \mu\text{s}$

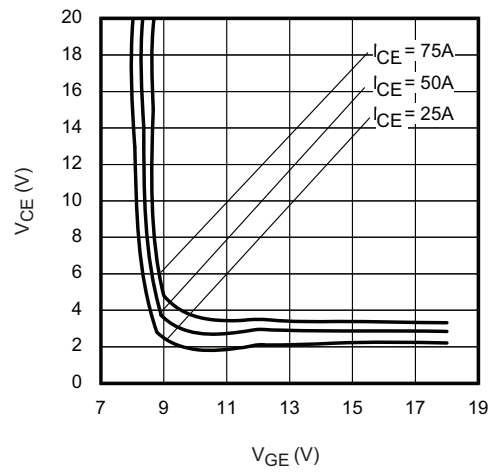


Fig. 8 - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$

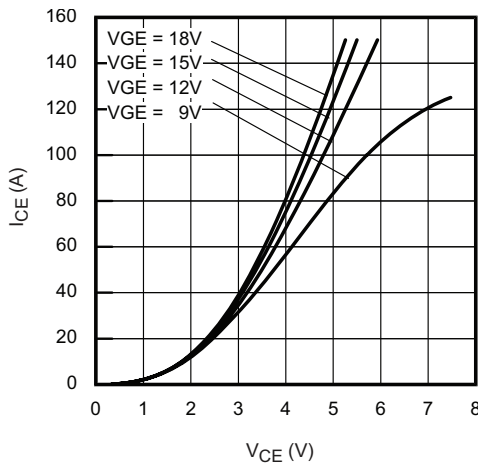


Fig. 6 - Typical IGBT Output Characteristics  
 $T_J = 125^\circ\text{C}$ ;  $t_p = 500 \mu\text{s}$

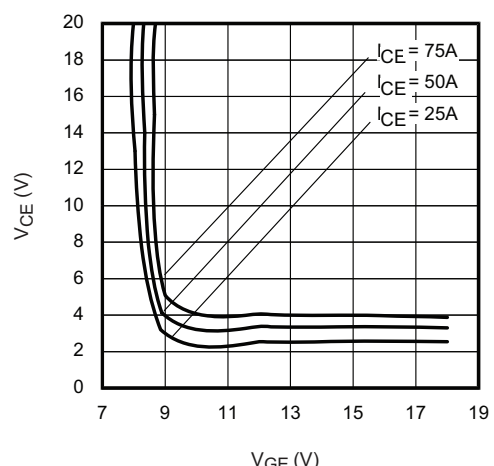


Fig. 9 - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 125^\circ\text{C}$

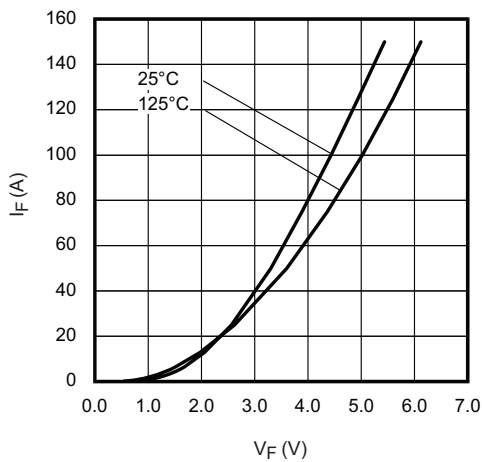


Fig. 7 - Typical Diode Forward Characteristics  
 $t_p = 500 \mu\text{s}$

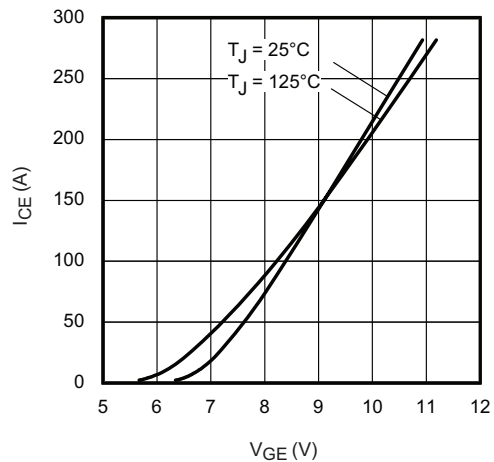


Fig. 10 - Typical Transfer Characteristics  
 $V_{CE} = 20 \text{ V}$ ;  $t_p = 500 \mu\text{s}$

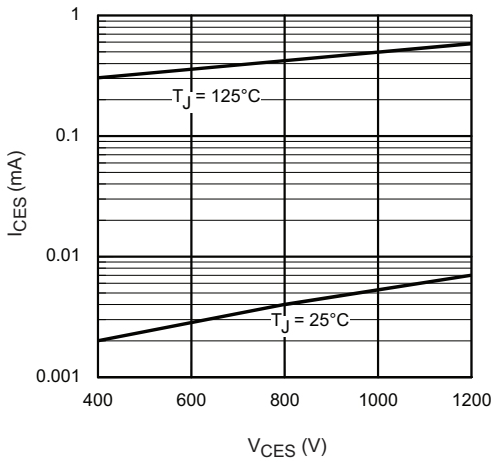


Fig. 11 - Typical Zero Gate Voltage Collector Current

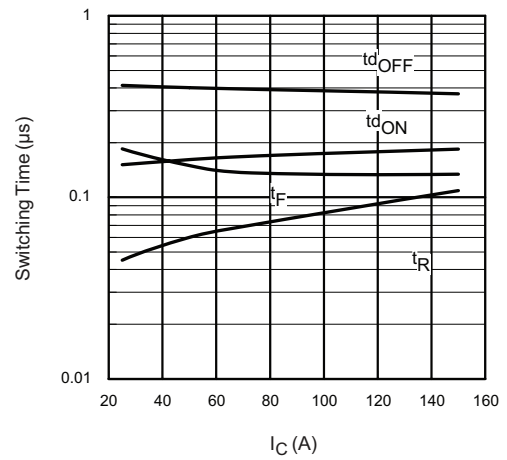
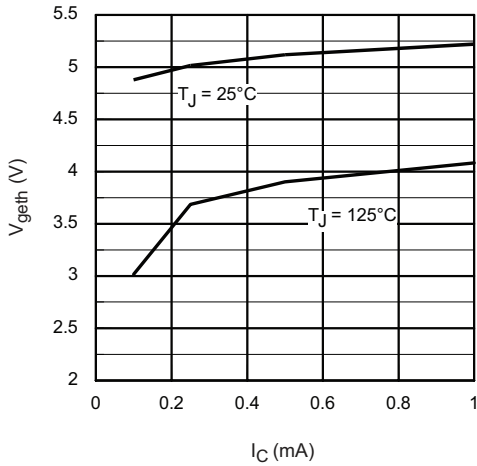
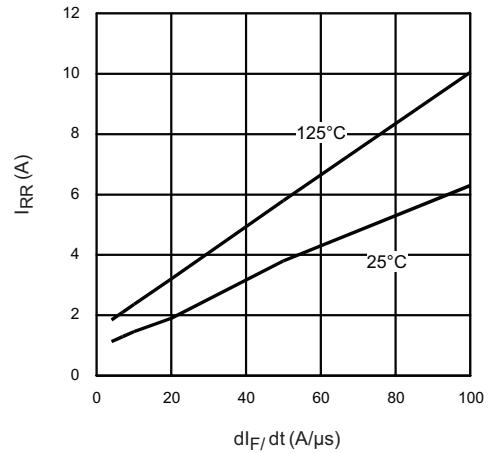
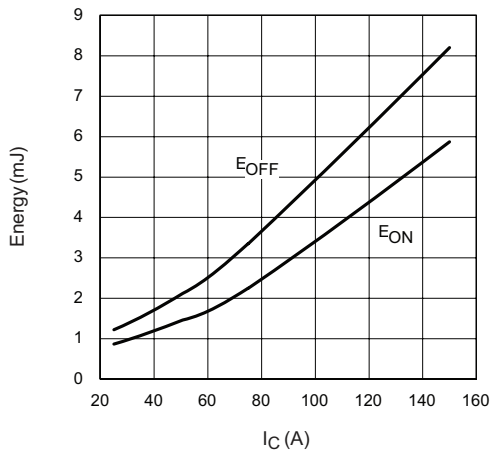
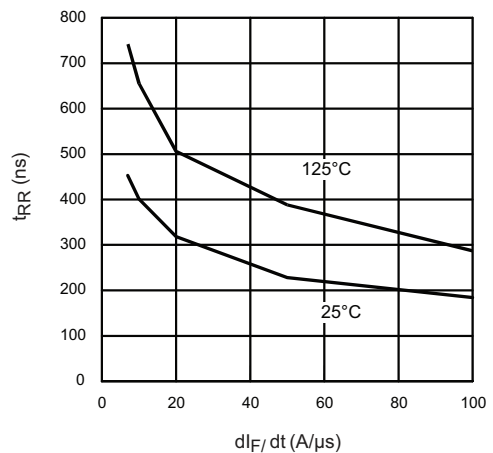

 Fig. 14 - Typical Switching Time vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 200\ \mu\text{H}$ ;  $V_{CE} = 600\ \text{V}$ ;  $R_G = 5\ \Omega$ ;  $V_{GE} = 15\ \text{V}$ 


Fig. 12 - Typical Threshold Voltage


 Fig. 15 - Typical Diode  $I_{REC}$  vs.  $dI_F/dt$   
 $V_{CC} = 600\ \text{V}$ ;  $I_F = 50\ \text{A}$ 

 Fig. 13 - Typical Energy Loss vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 200\ \mu\text{H}$ ;  $V_{CE} = 600\ \text{V}$ ;  $R_G = 5\ \Omega$ ;  $V_{GE} = 15\ \text{V}$ 

 Fig. 16 - Typical Diode  $t_{rr}$  vs.  $dI_F/dt$   
 $V_{CC} = 600\ \text{V}$ ;  $I_F = 50\ \text{A}$

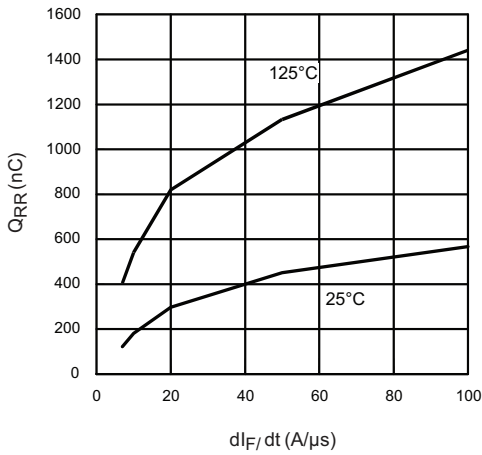


Fig. 17 - Typical Diode  $Q_{rr}$  vs.  $di_F/dt$   
 $V_{CC} = 600 \text{ V}$ ;  $I_F = 50 \text{ A}$

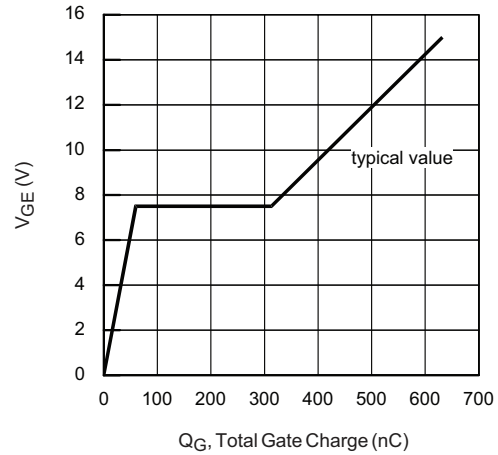


Fig. 18 - Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 5.0 \text{ A}$ ;  $L = 600 \mu\text{H}$

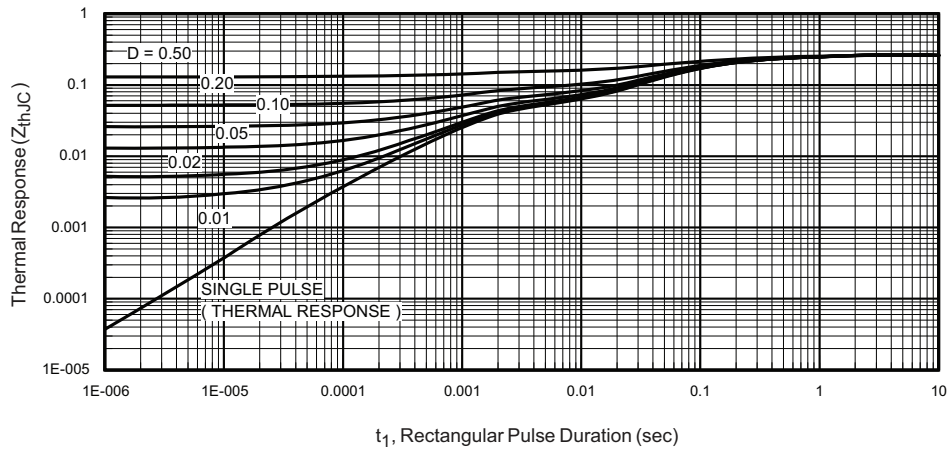


Fig. 19 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

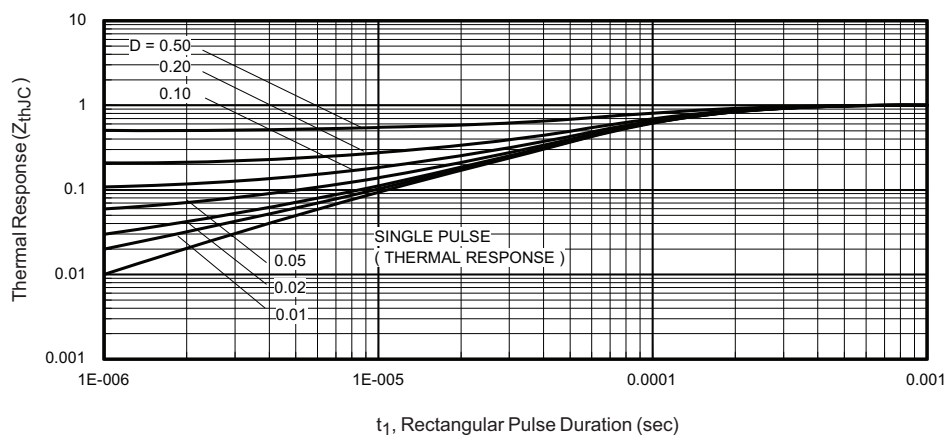


Fig. 20 - Maximum Transient Thermal Impedance, Junction to Case (DIODE)

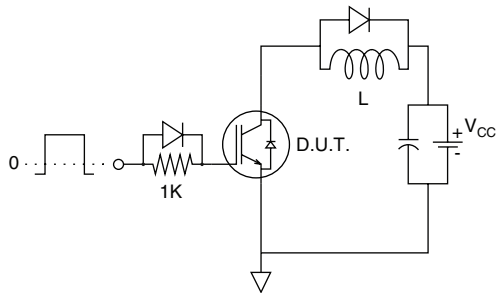


Fig. C.T.1 - Gate Charge Circuit (Turn-Off)

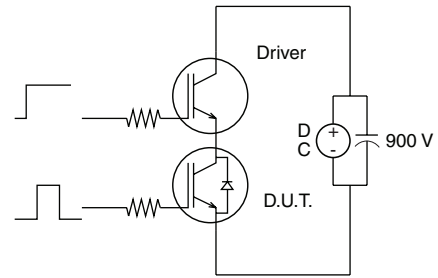


Fig. C.T.3 - S.C. SOA Circuit

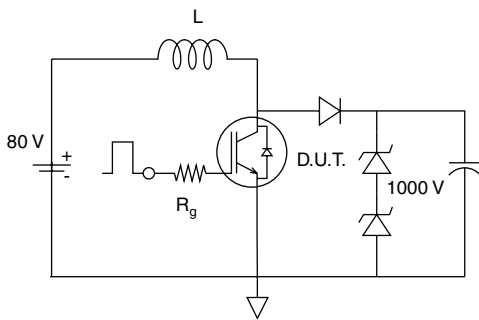


Fig. C.T.2 - RBSOA Circuit

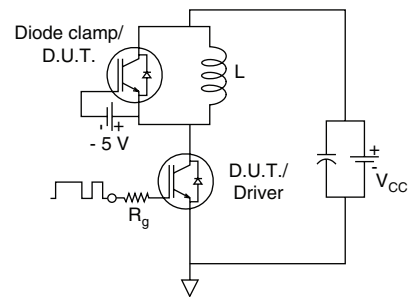


Fig. C.T.4 - Switching Loss Circuit

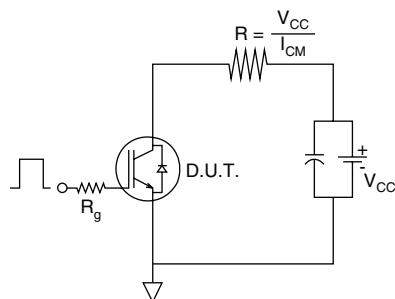
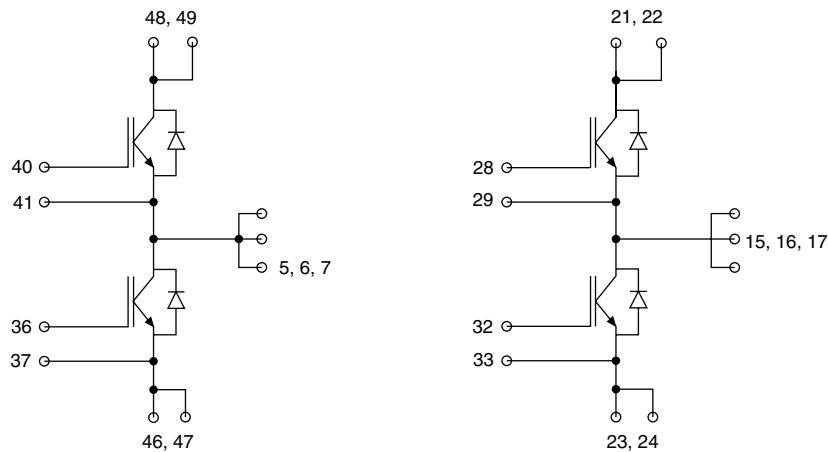


Fig. C.T.5 - Resistive Load Circuit

## ORDERING INFORMATION TABLE

|             |          |          |  |          |          |            |          |
|-------------|----------|----------|--|----------|----------|------------|----------|
| Device code | <b>G</b> | <b>B</b> | <b>75</b>  | <b>Y</b> | <b>F</b> | <b>120</b> | <b>N</b> |
|             | ①        | ②        | ③  | ④        | ⑤        | ⑥          | ⑦        |
|             | <b>1</b> | -        | Insulated gate bipolar transistor (IGBT)                     |          |          |            |          |
|             | <b>2</b> | -        | B = IGBT Generation 5 NPT                                    |          |          |            |          |
|             | <b>3</b> | -        | Current rating (75 = 75 A)                                   |          |          |            |          |
|             | <b>4</b> | -        | Circuit configuration (Y = Fourpack)                         |          |          |            |          |
|             | <b>5</b> | -        | Package indicator (F = ECONO2)                               |          |          |            |          |
|             | <b>6</b> | -        | Voltage rating (120 = 1200 V)                                |          |          |            |          |
|             | <b>7</b> | -        | Speed/type (ultrafast with reduced diode, speed 8 to 60 kHz) |          |          |            |          |

## CIRCUIT CONFIGURATION



### LINKS TO RELATED DOCUMENTS

Dimensions

<http://www.vishay.com/doc?95252>





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