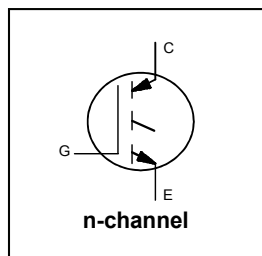


**Features**

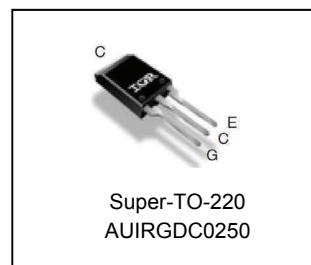
- Low  $V_{CE(on)}$  Planar IGBT Technology
- Low Switching Losses
- Square RBSOA
- 100% of the Parts Tested for ILM
- Positive  $V_{CE(on)}$  Temperature Coefficient
- Reflow Capable per JDS22-A113
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



$V_{CES} = 1200V$   
 $I_C = 81A @ T_C = 100^{\circ}C$   
 $V_{CE(on)} \text{ typ.} = 1.47V @ 33A$

**Benefits**

- Device optimized for soft switching applications
- High Efficiency due to Low  $V_{CE(on)}$ , low switching losses
- Rugged transient performance for increased reliability
- Excellent current sharing in parallel operation
- Low EMI



| G    | C         | E       |
|------|-----------|---------|
| Gate | Collector | Emitter |

**Application**

- PTC Heater
- Relay Replacement

| Base Part Number | Package Type | Standard Pack |          | Orderable Part Number |
|------------------|--------------|---------------|----------|-----------------------|
|                  |              | Form          | Quantity |                       |
| AUIRGDC0250      | Super-TO-220 | Tube          | 50       | AUIRGDC0250           |

**Absolute Maximum Ratings**

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature ( $T_A$ ) is  $25^{\circ}C$ , unless otherwise specified.

|                            | Parameter                                                   | Max.                              | Units       |
|----------------------------|-------------------------------------------------------------|-----------------------------------|-------------|
| $V_{CES}$                  | Collector-to-Emitter Voltage                                | 1200                              | V           |
| $I_C @ T_C = 25^{\circ}C$  | Continuous Collector Current                                | 141 <sup>④</sup>                  | A           |
| $I_C @ T_C = 100^{\circ}C$ | Continuous Collector Current                                | 81                                |             |
| $I_{CM}$                   | Pulse Collector Current, $V_{GE} = 15V$ <sup>②</sup>        | 99                                |             |
| $I_{LM}$                   | Clamped Inductive Load Current, $V_{GE} = 20V$ <sup>①</sup> | 99                                |             |
| $V_{GE}$                   | Continuous Gate-to-Emitter Voltage                          | $\pm 20$                          | V           |
|                            | Transient Gate-to-Emitter Voltage                           | $\pm 30$                          |             |
| $P_D @ T_C = 25^{\circ}C$  | Maximum Power Dissipation                                   | 543                               | W           |
| $P_D @ T_C = 100^{\circ}C$ | Maximum Power Dissipation                                   | 217                               |             |
| $T_J$                      | Operating Junction and                                      | -55 to +150                       | $^{\circ}C$ |
| $T_{STG}$                  | Storage Temperature Range                                   |                                   |             |
|                            | Soldering Temperature, for 10 sec. (Through Hole Mounting)  | 300 (0.063 in. (1.6mm) from case) |             |

**Thermal Resistance**

|                        | Parameter                                                      | Typ. | Max. | Units         |
|------------------------|----------------------------------------------------------------|------|------|---------------|
| $R_{\theta JC}$ (IGBT) | Thermal Resistance Junction-to-Case (each IGBT) <sup>③</sup>   | —    | 0.23 | $^{\circ}C/W$ |
| $R_{\theta CS}$        | Thermal Resistance, Case-to-Sink (flat, greased surface)       | 0.50 | —    |               |
| $R_{\theta JA}$        | Thermal Resistance, Junction-to-Ambient (typical socket mount) | —    | 62   |               |

\* Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

**Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

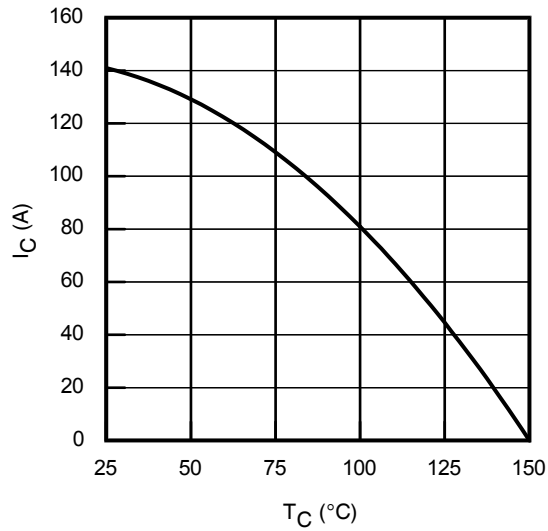
|                                 | Parameter                               | Min. | Typ. | Max.      | Units   | Conditions                                                             |
|---------------------------------|-----------------------------------------|------|------|-----------|---------|------------------------------------------------------------------------|
| $V_{(BR)CES}$                   | Collector-to-Emitter Breakdown Voltage  | 1200 | —    | —         | V       | $V_{GE} = 0V, I_C = 250\mu A$                                          |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | —    | 1.2  | —         | V/°C    | $V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$          |
| $V_{CE(on)}$                    | Collector-to-Emitter Saturation Voltage | —    | 1.47 | 1.8       | V       | $I_C = 33A, V_{GE} = 15V, T_J = 25^\circ\text{C}$                      |
|                                 |                                         | —    | 1.45 | —         |         | $I_C = 33A, V_{GE} = 15V, T_J = 150^\circ\text{C}$                     |
| $V_{GE(th)}$                    | Gate Threshold Voltage                  | 3.0  | —    | 6.0       | V       | $V_{CE} = V_{GE}, I_C = 250\mu A$                                      |
| $\Delta V_{GE(th)}/\Delta T_J$  | Threshold Voltage temp. coefficient     | —    | -15  | —         | mV/°C   | $V_{CE} = V_{GE}, I_C = 250\mu A (25^\circ\text{C}-150^\circ\text{C})$ |
| gfe                             | Forward Transconductance                | —    | 30   | —         | S       | $V_{CE} = 50V, I_C = 33A, PW = 20\mu S$                                |
| $I_{CES}$                       | Collector-to-Emitter Leakage Current    | —    | —    | 250       | $\mu A$ | $V_{GE} = 0V, V_{CE} = 1200V, T_J = 25^\circ\text{C}$                  |
|                                 |                                         | —    | —    | 1000      |         | $V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$                 |
| $I_{GES}$                       | Gate-to-Emitter Leakage Current         | —    | —    | $\pm 100$ | nA      | $V_{GE} = \pm 20V$                                                     |

**Switching Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

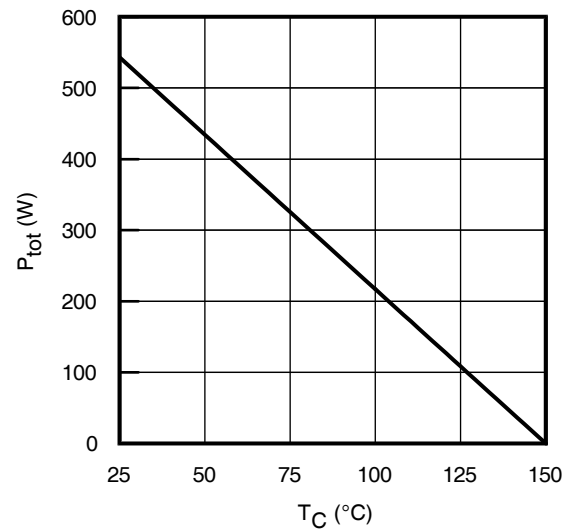
|                     | Parameter                          | Min.        | Typ. | Max. | Units | Conditions                                                                                                                                          |
|---------------------|------------------------------------|-------------|------|------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Q <sub>g</sub>      | Total Gate Charge (turn-on)        | —           | 151  | 227  | nC    | I <sub>C</sub> = 33A                                                                                                                                |
| Q <sub>ge</sub>     | Gate-to-Emitter Charge (turn-on)   | —           | 26   | 39   |       | V <sub>GE</sub> = 15V                                                                                                                               |
| Q <sub>gc</sub>     | Gate-to-Collector Charge (turn-on) | —           | 62   | 93   |       | V <sub>CC</sub> = 600V                                                                                                                              |
| E <sub>off</sub>    | Turn-Off Switching Loss            | —           | 15   | 16   | mJ    | I <sub>C</sub> = 33A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V                                                                                 |
| t <sub>d(off)</sub> | Turn-Off delay time                | —           | 485  | 616  | ns    | R <sub>G</sub> = 5Ω, L = 400μH, T <sub>J</sub> = 25°C                                                                                               |
| t <sub>f</sub>      | Fall time                          | —           | 1193 | 1371 |       | Energy losses include tail                                                                                                                          |
| E <sub>off</sub>    | Turn-Off Switching Loss            | —           | 29   | —    | mJ    | I <sub>C</sub> = 33A, V <sub>CC</sub> = 600V, V <sub>GE</sub> = 15V                                                                                 |
| t <sub>d(off)</sub> | Turn-Off delay time                | —           | 689  | —    | ns    | R <sub>G</sub> = 5Ω, L = 400μH, T <sub>J</sub> = 150°C                                                                                              |
| t <sub>f</sub>      | Fall time                          | —           | 2462 | —    |       | Energy losses include tail                                                                                                                          |
| C <sub>ies</sub>    | Input Capacitance                  | —           | 3804 | —    | pF    | V <sub>GE</sub> = 0V                                                                                                                                |
| C <sub>oes</sub>    | Output Capacitance                 | —           | 161  | —    |       | V <sub>CC</sub> = 30V                                                                                                                               |
| C <sub>res</sub>    | Reverse Transfer Capacitance       | —           | 31   | —    |       | f = 1.0Mhz                                                                                                                                          |
| RBSOA               | Reverse Bias Safe Operating Area   | FULL SQUARE |      |      |       | T <sub>J</sub> = 150°C, I <sub>C</sub> = 99A<br>V <sub>CC</sub> = 960V, V <sub>p</sub> ≤ 1200V<br>R <sub>g</sub> = 5Ω, V <sub>GE</sub> = +20V to 0V |

**Notes:**

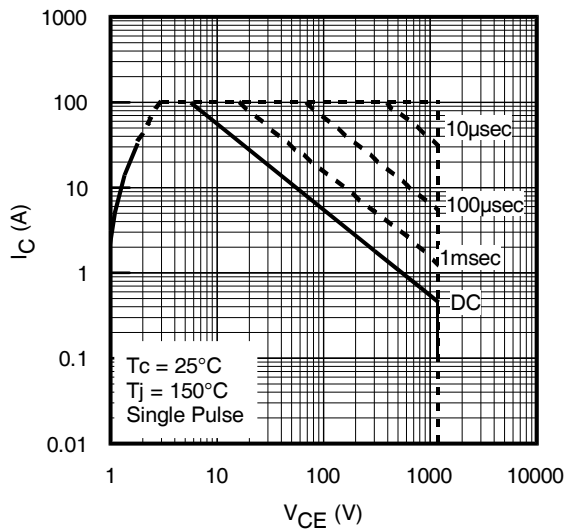
- ①  $V_{CC} = 80\% (V_{CES}), V_{GE} = 20V, L = 400\mu H, R_G = 5\Omega$ .
- ② Pulse width limited by max. junction temperature.
- ③  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$ .
- ④ Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 78A.  
Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.



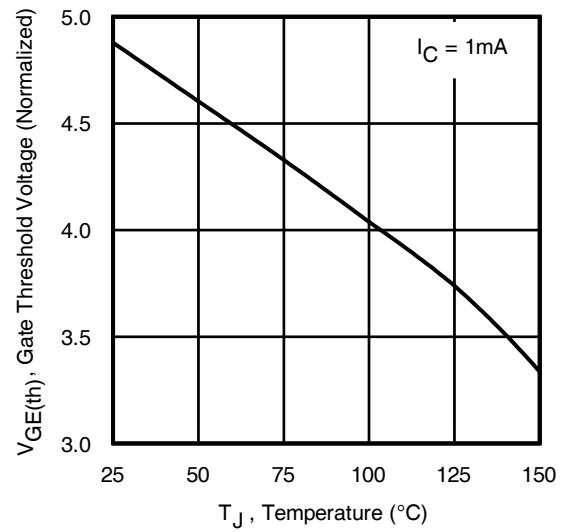
**Fig. 1** - Maximum DC Collector Current vs. Case Temperature



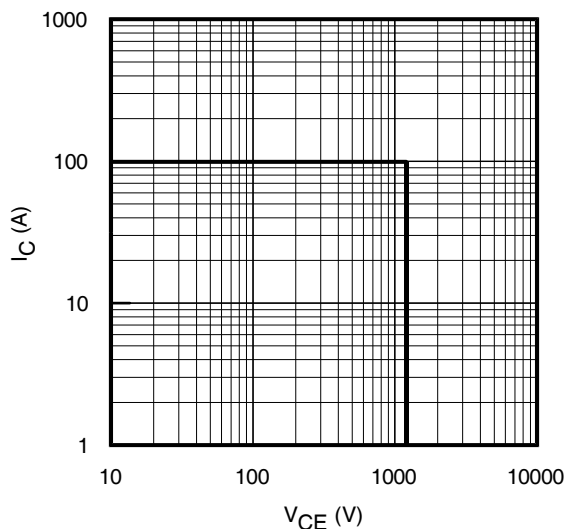
**Fig. 2** - Power Dissipation vs. Case Temperature



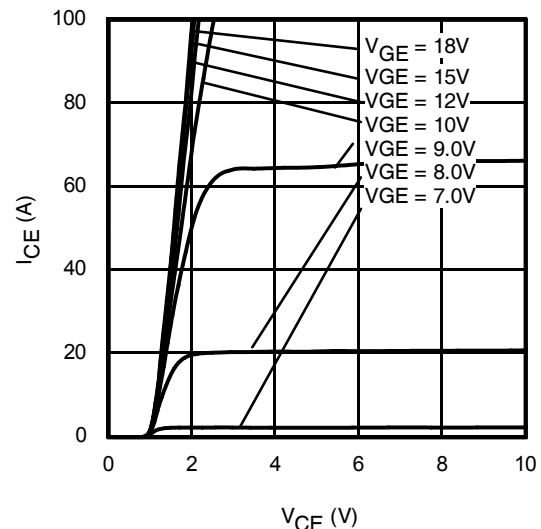
**Fig. 3** - Forward SOA  
 $T_C = 25^\circ\text{C}$ ,  $T_J \leq 150^\circ\text{C}$ ;  $V_{GE} = 15\text{V}$



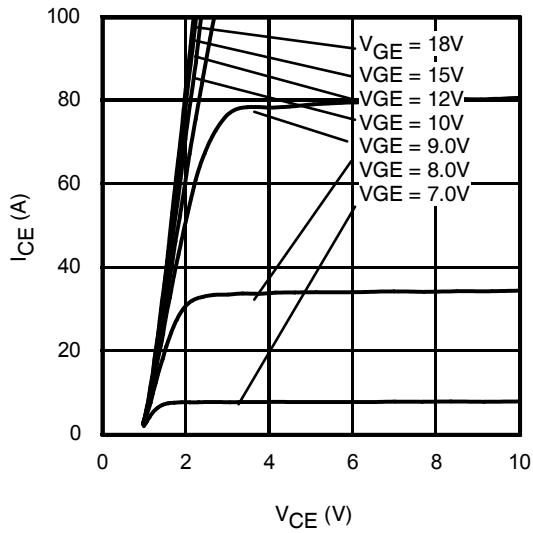
**Fig. 4** - Typical Gate Threshold Voltage (Normalized) vs. Junction Temperature



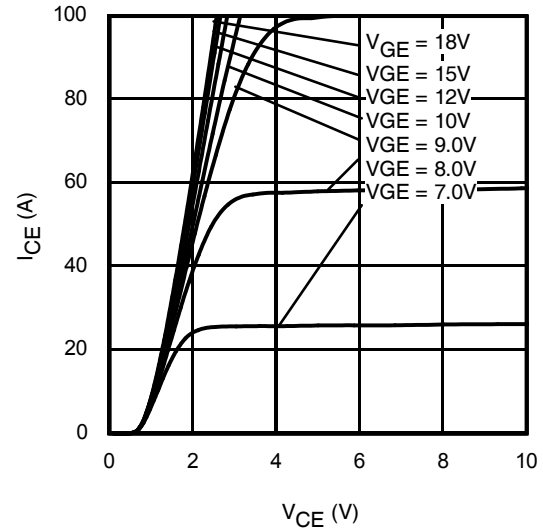
**Fig. 5** - Reverse Bias SOA  
 $T_J = 150^\circ\text{C}$ ;  $V_{GE} = 20\text{V}$



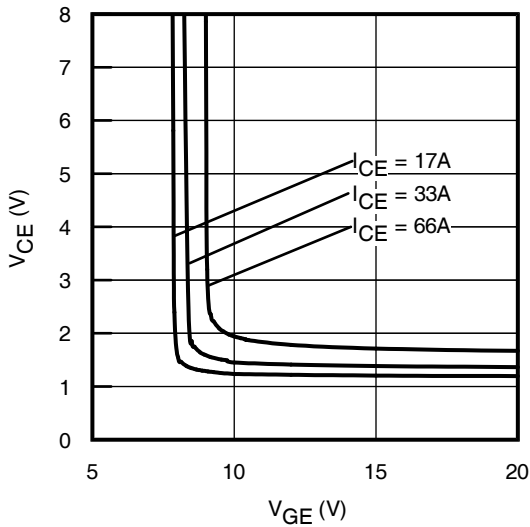
**Fig. 6** - Typ. IGBT Output Characteristics  
 $T_J = -40^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



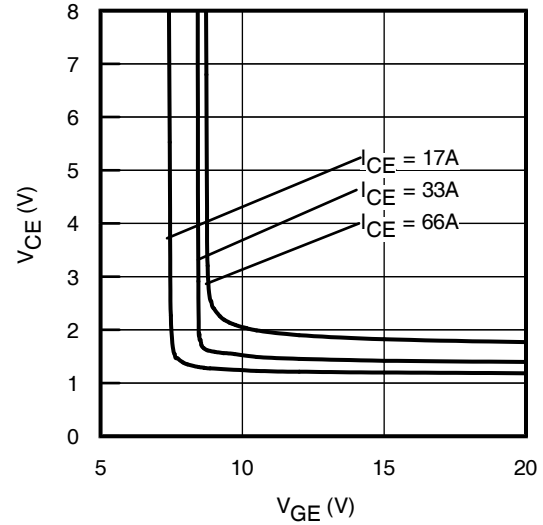
**Fig. 7 - Typ. IGBT Output Characteristics**  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



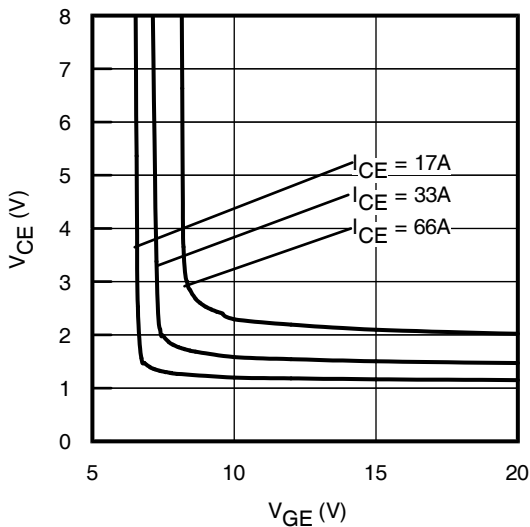
**Fig. 8 - Typ. IGBT Output Characteristics**  
 $T_J = 150^\circ\text{C}$ ;  $t_p = 20\mu\text{s}$



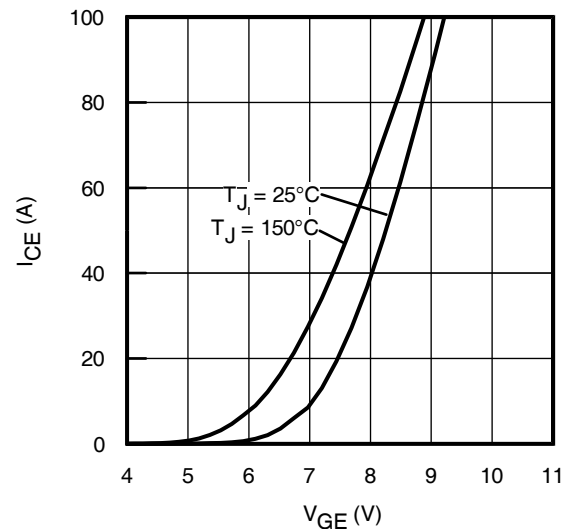
**Fig. 9 - Typical  $V_{CE}$  vs.  $V_{GE}$**   
 $T_J = -40^\circ\text{C}$



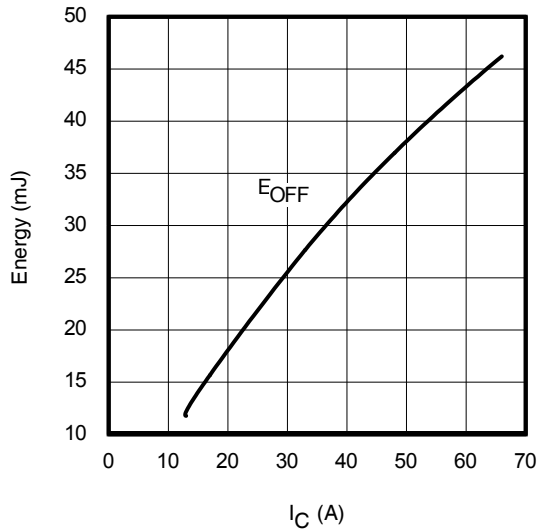
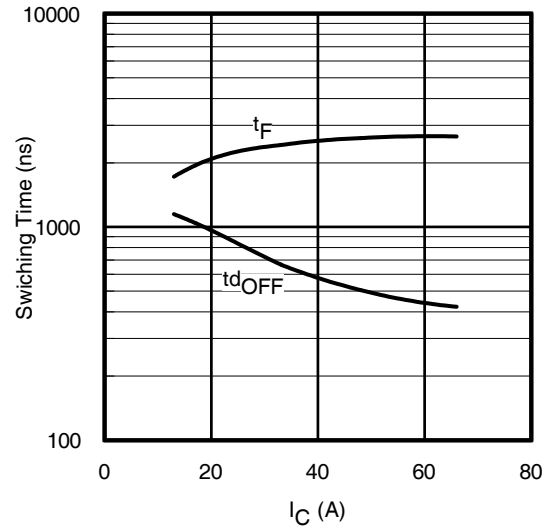
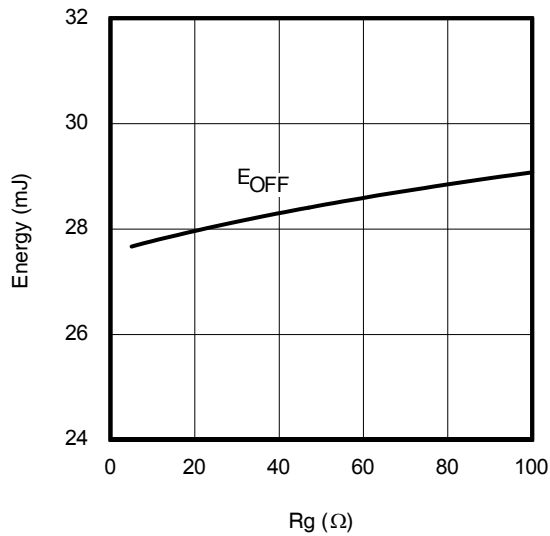
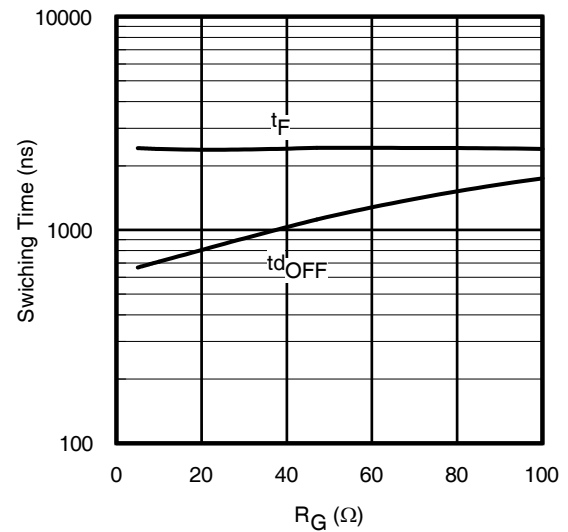
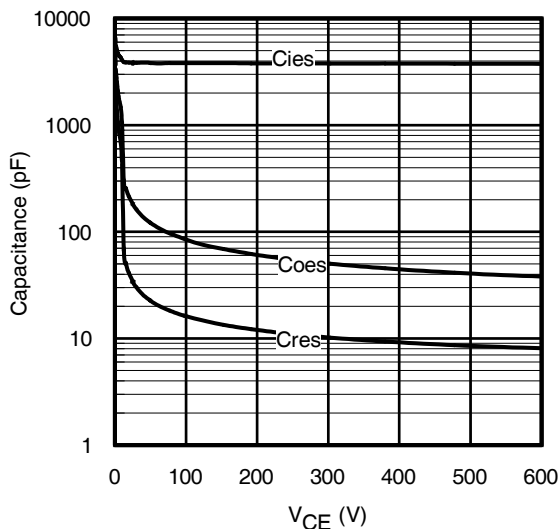
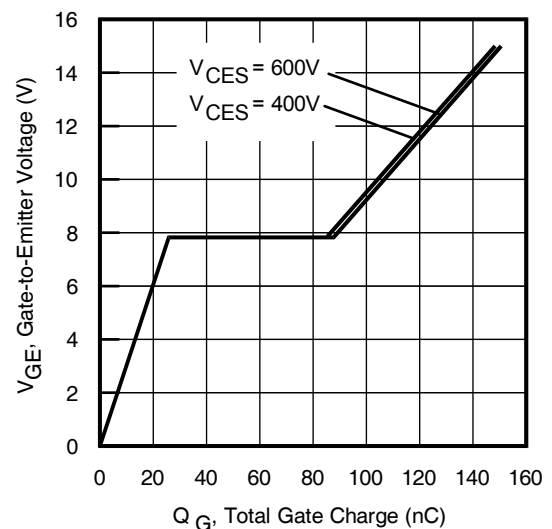
**Fig. 10 - Typical  $V_{CE}$  vs.  $V_{GE}$**   
 $T_J = 25^\circ\text{C}$

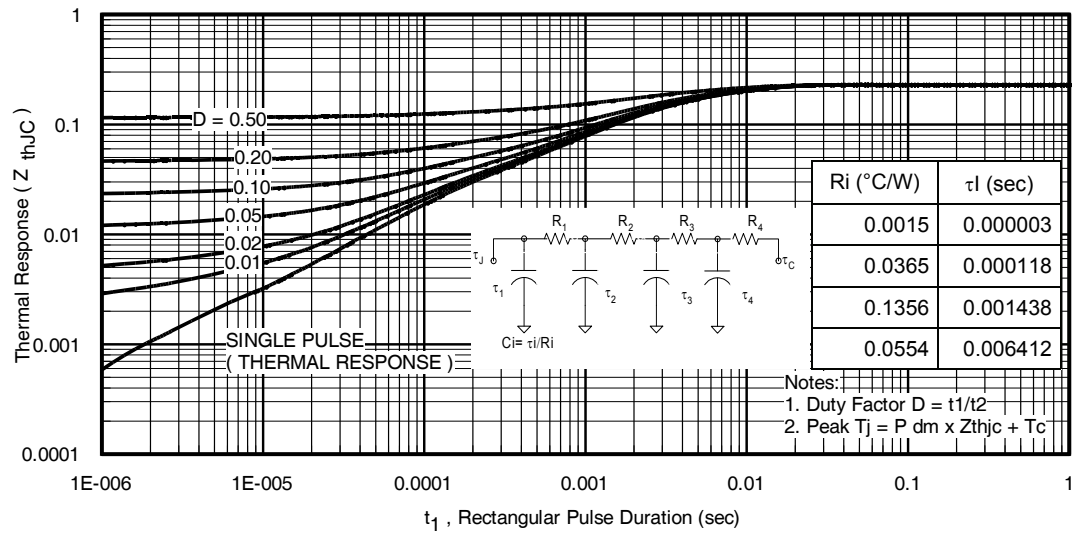


**Fig. 11 - Typical  $V_{CE}$  vs.  $V_{GE}$**   
 $T_J = 150^\circ\text{C}$

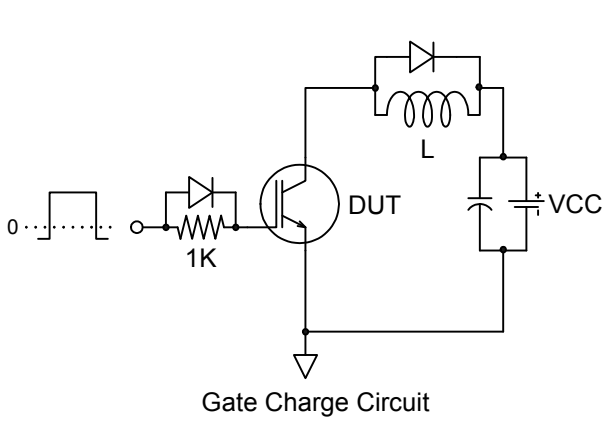
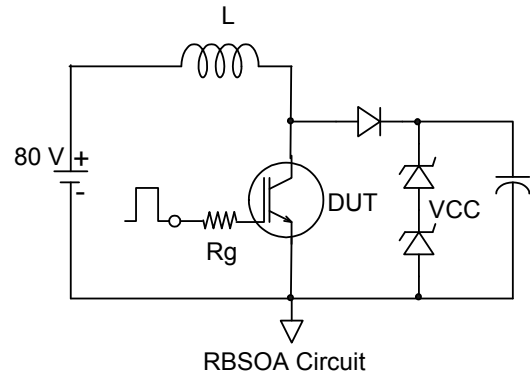
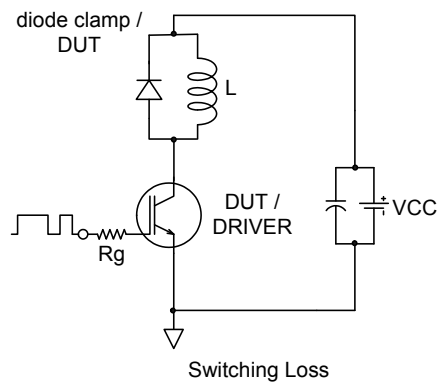
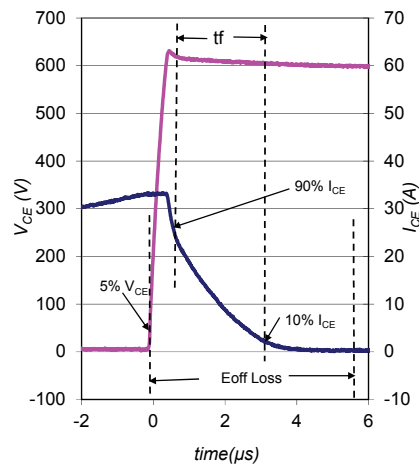


**Fig. 12 - Typ. Transfer Characteristics**  
 $V_{CE} = 50\text{V}$ ;  $t_p = 20\mu\text{s}$


**Fig. 13 - Typ. Energy Loss vs.  $I_C$** 
 $T_J = 150^\circ\text{C}; L = 400\mu\text{H}; V_{CE} = 600\text{V}, R_G = 5\Omega; V_{GE} = 15\text{V}$ 

**Fig. 14 - Typ. Switching Time vs.  $I_C$** 
 $T_J = 150^\circ\text{C}; L = 400\mu\text{H}; V_{CE} = 600\text{V}, R_G = 5\Omega; V_{GE} = 15\text{V}$ 

**Fig. 15 - Typ. Energy Loss vs.  $R_G$** 
 $T_J = 150^\circ\text{C}; L = 400\mu\text{H}; V_{CE} = 600\text{V}, I_{CE} = 33\text{A}; V_{GE} = 15\text{V}$ 

**Fig. 16 - Typ. Switching Time vs.  $R_G$** 
 $T_J = 150^\circ\text{C}; L = 400\mu\text{H}; V_{CE} = 600\text{V}, I_{CE} = 33\text{A}; V_{GE} = 15\text{V}$ 

**Fig. 17 - Typ. Capacitance vs.  $V_{CE}$**   
 $V_{GE} = 0\text{V}; f = 1\text{MHz}$ 

**Fig. 18 - Typical Gate Charge vs.  $V_{GE}$**   
 $I_{CE} = 33\text{A}; L = 2.0\text{mH}$

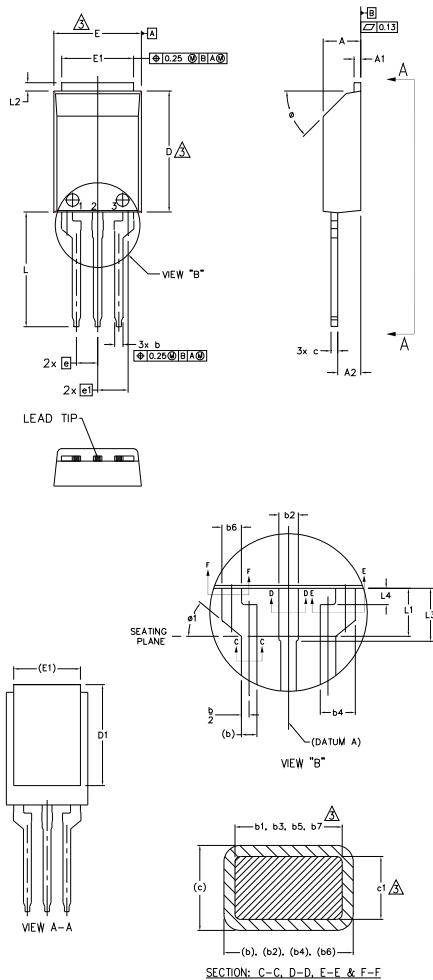


**Fig 19.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)


**Fig.C.T.1** - Gate Charge Circuit (turn-off)

**Fig.C.T.2** - RBSOA Circuit

**Fig.C.T.3** - Switching Loss Circuit

**Fig. WF1** - Typ. Turn-off Loss Waveform  
@ T<sub>J</sub> = 150°C using Fig. CT.3

## Super-TO-220 Package Outline

Dimensions are shown in millimeters (inches)



### NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
2. DIMENSIONS b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER EXTREMES OF THE PLASTIC BODY.
4. ALL DIMENSIONS SHOWN IN MILLIMETERS.
5. CONTROLLING DIMENSION: MILLIMETER.
6. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.

| SYMBOL | DIMENSIONS  |       |          |       | NOTES |
|--------|-------------|-------|----------|-------|-------|
|        | MILLIMETERS |       | INCHES   |       |       |
|        | MIN.        | MAX.  | MIN.     | MAX.  |       |
| A      | 4.34        | 4.74  | .171     | .187  |       |
| A1     | 0.50        | 1.00  | .020     | .039  |       |
| A2     | 2.50        | 3.00  | .098     | .118  |       |
| b      | 0.90        | 1.30  | .035     | .051  |       |
| b1     | 0.80        | 1.10  | .031     | .043  | 2     |
| b2     | 1.25        | 1.65  | .049     | .065  |       |
| b3     | 1.10        | 1.55  | .043     | .061  | 2     |
| b4     | 2.35        | 2.55  | .093     | .100  |       |
| b5     | 2.30        | 2.50  | .091     | .098  | 2     |
| b6     | 1.25        | 1.65  | .049     | .065  |       |
| b7     | 1.10        | 1.55  | .043     | .061  | 2     |
| c      | 0.70        | 1.00  | .028     | .039  |       |
| c1     | 0.60        | 0.90  | .024     | .035  | 2     |
| D      | 14.00       | 15.00 | .0551    | .591  | 3     |
| D1     | 12.50       | 13.50 | .492     | .531  |       |
| E      | 10.00       | 11.00 | .394     | .433  | 3     |
| E1     | 8.00        | 9.00  | .315     | .354  |       |
| e      | 2.55 BSC    |       | .100 BSC |       |       |
| e1     | 3.66 BSC    |       | .144 BSC |       |       |
| L      | 13.00       | 14.50 | .512     | .571  |       |
| L1     | 3.00        | 3.50  | .118     | .138  |       |
| L2     | 0.50        | 1.50  | .020     | .059  |       |
| L3     | 3.50        | 4.00  | .138     | .157  |       |
| L4     | —           | 1.50  | —        | .059  |       |
| ø      | 42.5*       | 47.5* | 42.5*    | 47.5* |       |
| ø1     | —           | 42.5* | —        | 42.5* |       |

### LEAD ASSIGNMENTS

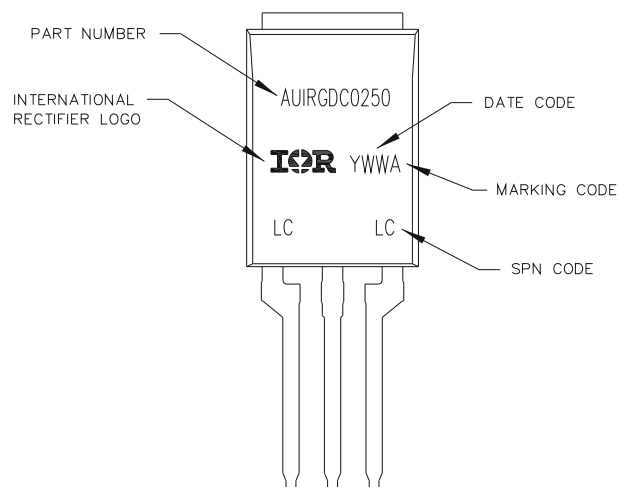
#### MOSFET

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

#### IGBT

1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

## Super-TO-220 Part Marking Information





**Qualification Information**

|                                   |                      |                                                                                                                                                                                |      |
|-----------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Qualification Level</b>        |                      | Automotive<br>(per AEC-Q101)                                                                                                                                                   |      |
|                                   |                      | Comments: This part number (s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level. |      |
| <b>Moisture Sensitivity Level</b> |                      | 3L– Super TO-220                                                                                                                                                               | MSL1 |
| <b>ESD</b>                        | Machine Model        | Class M4 <sup>†</sup> (+/- 800V)<br>AEC-Q101-002                                                                                                                               |      |
|                                   | Human Body Model     | Class H3A <sup>†</sup> (+/- 6000V)<br>AEC-Q101-001                                                                                                                             |      |
|                                   | Charged Device Model | Class C5 <sup>†</sup> (+/- 2000V)<br>AEC-Q101-005                                                                                                                              |      |
| <b>RoHS Compliant</b>             |                      | Yes                                                                                                                                                                            |      |

† Highest passing voltage.

**Revision History**

| Revision | Date       | Subjects (major changes since last revision)             |
|----------|------------|----------------------------------------------------------|
| 2.0      | 9/2/2014   | • Final Datasheet                                        |
| 2.1      | 12/1/2014  | • Updated with $V_{(BR)CES}$ and $V_{GE(th)}$ conditions |
| 2.2      | 3/2/2015   | • Updated with minor changes                             |
| 2.3      | 8/31/2017  | • Updated with Infineon logo                             |
| 2.4      | 03/01/2018 | • Updated with qualification level                       |
| 2.5      | 11/06/2018 | • Updated maximum $V_{CE(on)}$                           |

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