



# UG15N41

## Insulated Gate Bipolar Transistor

### 15A, 410V NPT SERIES N-CHANNEL IGBT

■ DESCRIPTION

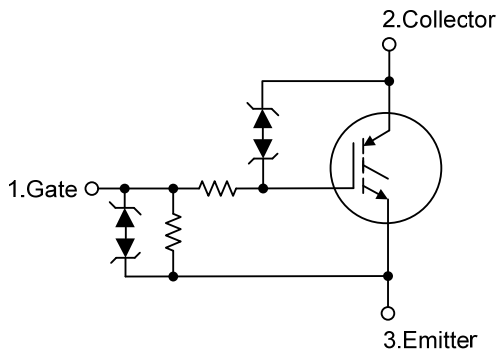
The UTC **UG15N41** is a Logic Level Insulated Gate Bipolar Transistor features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. it uses UTC's advanced technology to provide the customers with a minimum on-state resistance, etc.

The UTC **UG15N41** is suitable for AC and DC motor controls, power supplies, and drivers for solenoids, relays and contactors, etc.

■ FEATURES

- \* Temperature Compensated Gate-Collector Voltage Clamp  
Limits Stress Applied to Load Devices
- \* Low Saturation Voltage
- \* High Pulsed Current Capability

■ SYMBOL

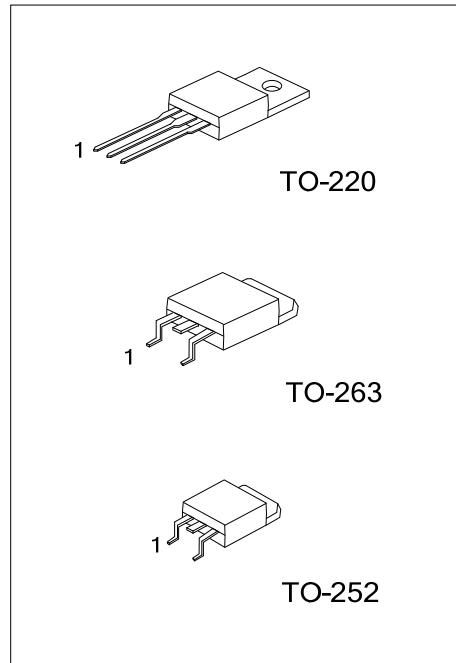


■ ORDERING INFORMATION

| Ordering Number |                | Package | Pin Assignment |   |   | Packing   |
|-----------------|----------------|---------|----------------|---|---|-----------|
| Lead Free       | Halogen Free   |         | 1              | 2 | 3 |           |
| UG15N41L-TA3-T  | UG15N41G-TA3-T | TO-220  | G              | C | E | Tube      |
| UG15N41L-TN3-R  | UG15N41G-TN3-R | TO-252  | G              | C | E | Tape Reel |
| UG15N41L-TQ2-T  | UG15N41G-TQ2-T | TO-263  | G              | C | E | Tube      |
| UG15N41L-TQ2-R  | UG15N41G-TQ2-R | TO-263  | G              | C | E | Tape Reel |

Note: Pin Assignment: G: Gate C: Collector E: Emitter

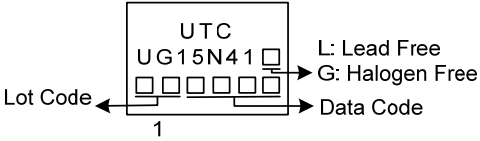
|   |  |
|---|--|
| <p>UG15N41L-TA3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p> | <p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TN3: TO-252, TQ2: TO-263</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p> |
|---|--|



# UG15N41

# Insulated Gate Bipolar Transistor

■ MARKING



■ ABSOLUTE MAXIMUM RATING ( $T_J=25^\circ\text{C}$ , unless otherwise specified)

| PARAMETER                            |                                 | SYMBOL                 | RATINGS    | UNIT             |                           |
|--------------------------------------|---------------------------------|------------------------|------------|------------------|---------------------------|
| Collector to Emitter Voltage         |                                 | $V_{CES}$              | 440        | V                |                           |
| Collector to Gate Voltage            |                                 | $V_{GER}$              | 440        | V                |                           |
| Gate to Emitter Voltage              |                                 | $V_{GE}$               | 15         | V                |                           |
| Collector Current to Continuous      | $T_J=25^\circ\text{C}$          | $I_C$                  | 15         | A                |                           |
| Collector Emitter Avalanche Energy   |                                 | $T_J=25^\circ\text{C}$ | EAS        | 200              | mJ                        |
| Power Dissipation                    | $T_C=25^\circ\text{C}$          | TO-220                 | $P_D$      | 110              | W                         |
|                                      |                                 | TO-252                 |            | 107              | W                         |
|                                      |                                 | TO-263                 |            |                  |                           |
|                                      | Derate above $25^\circ\text{C}$ | TO-220                 |            | 0.76             | $\text{W}/^\circ\text{C}$ |
|                                      |                                 | TO-252                 |            | 0.71             | $\text{W}/^\circ\text{C}$ |
|                                      |                                 | TO-263                 |            |                  |                           |
| Operating Junction Temperature Range |                                 | $T_J$                  | -55 ~ +175 | $^\circ\text{C}$ |                           |
| Storage Temperature Range            |                                 | $T_{STG}$              | -55 ~ +175 | $^\circ\text{C}$ |                           |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Pulse width limited by maximum junction temperature.

3.  $V_{CC}=50\text{V}$ ,  $V_{GE}=5.0\text{V}$ ,  $\text{Pk } I_L=11\text{A}$ ,  $L=3\text{mH}$ , Starting  $T_J=25^\circ\text{C}$ .

■ THERMAL CHARACTERISTICS

| PARAMETER           |        | SYMBOL        | RATINGS | UNIT                      |
|---------------------|--------|---------------|---------|---------------------------|
| Junction to Ambient | TO-220 | $\theta_{JA}$ | 62.5    | $^\circ\text{C}/\text{W}$ |
|                     | TO-252 |               | 100     | $^\circ\text{C}/\text{W}$ |
|                     | TO-263 |               | 50      | $^\circ\text{C}/\text{W}$ |
| Junction to Case    | TO-220 | $\theta_{JC}$ | 1.13    | $^\circ\text{C}/\text{W}$ |
|                     | TO-252 |               | 1.40    | $^\circ\text{C}/\text{W}$ |
|                     | TO-263 |               | 1.16    | $^\circ\text{C}/\text{W}$ |

■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

| PARAMETER                              | SYMBOL              | TEST CONDITIONS                                       | MIN                         | TYP  | MAX  | UNIT |       |
|--|---------------------|---|-----------------------------|------|------|------|-------|
| <b>OFF CHARACTERISTICS</b>             |                     |   |                             |      |      |      |       |
| Collector to Emitter Breakdown Voltage | BV <sub>CES</sub>   | I <sub>C</sub> =2.0mA, V <sub>GE</sub> =0V            | T <sub>J</sub> =-40°C~150°C | 380  |      | 440  | V     |
|  |                     | I <sub>C</sub> =10mA, V <sub>GE</sub> =0V             |                             | 380  |      | 440  | V     |
| Collector to Emitter Leakage Current   | I <sub>CES</sub>    | V <sub>CE</sub> =350V, V <sub>GE</sub> =0V            | T <sub>J</sub> =25°C        |      | 2.0  | 20   | μA    |
|  |                     |   | T <sub>J</sub> =125°C       |      | 10   | 40   | μA    |
|  |                     |   | T <sub>J</sub> =-40°C       |      | 1.0  | 10   | μA    |
| Collector to Emitter Leakage Current   | I <sub>ECS</sub>    | V <sub>CE</sub> =-24V                                 | T <sub>J</sub> =25°C        |      | 0.7  | 2.0  | mA    |
|  |                     |   | T <sub>J</sub> =125°C       |      | 12   | 25   | mA    |
|  |                     |   | T <sub>J</sub> =-40°C       |      | 0.1  | 1.0  | mA    |
| Collector to Emitter Clamp Voltage     | BV <sub>ECS</sub>   | I <sub>C</sub> =-75mA                                 | T <sub>J</sub> =25°C        | 35   | 39   | 42   | V     |
|  |                     |   | T <sub>J</sub> =125°C       | 38   | 42   | 45   | V     |
|  |                     |   | T <sub>J</sub> =-40°C       | 31   | 35   | 40   | V     |
| Gate to Emitter Clamp Voltage          | BV <sub>GES</sub>   | I <sub>G</sub> =5.0mA                                 | T <sub>J</sub> =-40°C~150°C | 11   | 14   | 16   | V     |
| Gate to Emitter Leakage Current        | I <sub>GES</sub>    | V <sub>GE</sub> =10V                                  | T <sub>J</sub> =-40°C~150°C | 384  | 640  | 1000 | μA    |
| Gate Resistor                          | R <sub>G</sub>      |   | T <sub>J</sub> =-40°C~150°C |      | 70   |      | Ω     |
| Gate Emitter Resistor                  | R <sub>GE</sub>     |   | T <sub>J</sub> =-40°C~150°C | 10   | 16   | 26   | kΩ    |
| <b>ON CHARACTERISTICS (Note 2)</b>     |                     |   |                             |      |      |      |       |
| Gate to Emitter Threshold Voltage      | V <sub>GE(TH)</sub> | I <sub>C</sub> =1mA, V <sub>CE</sub> =V <sub>GE</sub> | T <sub>J</sub> =25°C        | 1.2  | 1.45 | 1.7  | V     |
|  |                     |   | T <sub>J</sub> =125°C       | 0.75 | 1.1  | 1.4  | V     |
|  |                     |   | T <sub>J</sub> =-40°C       | 1.2  | 1.7  | 2.1  | V     |
| Threshold Temperature Coefficient      |                     |   |                             | 3.4  |      |      | mV/°C |

### ■ ELECTRICAL CHARACTERISTICS (Cont.)

| PARAMETER                          | SYMBOL       | TEST CONDITIONS  | MIN                                | TYP | MAX  | UNIT |               |
|------------------------------------|--------------|--|------------------------------------|-----|------|------|---------------|
| <b>ON CHARACTERISTICS (Note 3)</b> |              |  |                                    |     |      |      |               |
| Collector to Emitter On Voltage    | $V_{CE(ON)}$ | $I_C=6.0A, V_{GE}=4.0V$  | $T_J=25^\circ C$                   | 0.9 | 1.1  | 1.8  | V             |
|                                    |              |  | $T_J=150^\circ C$                  |     | 0.9  | 1.8  | V             |
|                                    |              |  | $T_J=-40^\circ C$                  |     | 1.2  | 1.9  | (Note 3)<br>V |
|                                    |              | $I_C=10A, V_{GE}=4.0V$   | $T_J=25^\circ C$                   | 1.2 | 1.35 | 2.2  | V             |
|                                    |              |  | $T_J=150^\circ C$                  |     | 1.5  | 2.3  | (Note 3)<br>V |
|                                    |              |  | $T_J=-40^\circ C$                  |     | 1.4  | 2.2  | V             |
|                                    |              | $I_C=10A, V_{GE}=4.5V$   | $T_J=25^\circ C$                   | 1.1 | 1.3  | 2.2  | V             |
|                                    |              |  | $T_J=150^\circ C$                  |     | 1.5  | 2.1  | V             |
|                                    |              |  | $T_J=-40^\circ C$                  |     | 1.6  | 2.1  | (Note 3)<br>V |
| Forward Transconductance           | $g_{FS}$     | $V_{GE}=5.0V, I_C=6.0A$  | $T_J=-40^\circ C \sim 150^\circ C$ | 8.0 | 15   | 25   | S             |
| <b>DYNAMIC CHARACTERISTICS</b>     |              |  |                                    |     |      |      |               |
| Input Capacitance                  | $C_{ISS}$    | $V_{CC}=25V, V_{GE}=0V,$<br>$f=1.0\text{ MHz}$                 | $T_J=-25^\circ C$                  |     | 550  |      | pF            |
| Output Capacitance                 | $C_{OSS}$    |  |                                    |     | 165  |      | pF            |
| Reverse Transfer Capacitance       | $C_{RSS}$    |  |                                    |     | 75   |      | pF            |
| <b>SWITCHING CHARACTERISTICS</b>   |              |  |                                    |     |      |      |               |
| Turn-Off Delay Time (Inductive)    | $t_{d(OFF)}$ | $V_{CC}=300V, I_C=6.5A$<br>$R_G=1.0k\Omega,$<br>$R_L=300\mu H$ | $T_J=25^\circ C$                   |     | 4.0  | 10   | $\mu S$       |
|                                    |              |  | $T_J=150^\circ C$                  |     | 4.5  | 10   | $\mu S$       |
|                                    |              |  | $T_J=25^\circ C$                   |     | 3.0  | 10   | $\mu S$       |
| Turn-On Delay Time                 | $t_{d(ON)}$  | $V_{CC}=10V, I_C=6.5A$<br>$R_G=1.0k\Omega, R_L=1.5\Omega$      | $T_J=25^\circ C$                   |     | 0.7  | 4.0  | $\mu S$       |
|                                    |              |  | $T_J=150^\circ C$                  |     | 0.7  | 4.0  | $\mu S$       |
| Fall Time (Inductive)              | $t_F$        | $V_{CC}=300V, I_C=6.5A$<br>$R_G=1.0k\Omega,$<br>$R_L=300\mu H$ | $T_J=25^\circ C$                   |     | 6.0  | 12   | $\mu S$       |
|                                    |              |  | $T_J=150^\circ C$                  |     | 10   | 12   | $\mu S$       |
| Fall Time (Resistive)              | $t_F$        | $V_{CC}=300V, I_C=6.5A$<br>$R_G=1.0k\Omega, R_L=46\Omega$      | $T_J=25^\circ C$                   |     | 8.0  | 15   | $\mu S$       |
|                                    |              |  | $T_J=150^\circ C$                  |     | 12   | 15   | $\mu S$       |
| Rise Time                          | $t_F$        | $V_{CC}=10V, I_C=6.5A$<br>$R_G=1.0k\Omega, R_L=1.5\Omega$      | $T_J=25^\circ C$                   |     | 4.0  | 7.0  | $\mu S$       |
|                                    |              |  | $T_J=150^\circ C$                  |     | 5.0  | 7.0  | $\mu S$       |

Notes: 1. When surface mounted to an FR4 board using the minimum recommended pad size.

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

3. Maximum Value of Characteristic across Temperature Range.

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