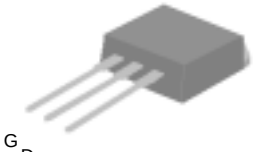
# N-channel Insulated-Gate Bipolar Transistor

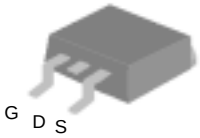
## PRODUCT SUMMARY

| | |
|---|---|
| $V_{CES}$ | 450V |
| $V_{CE(sat)}$ | 5V typ. |
| $I_{CP}$ | 130A |

**Pb-free; RoHS-compliant TO-251 (IPAK) and TO-252 (DPAK)**




TO-251 (suffix J)




TO-252 (suffix H)

## DESCRIPTION

The SSM20G45E acheives fast switching performance with low gate charge without a complex drive circuit. It is suitable for use in short-duration, high-current strobe applications, such as still-camera flash.

The SSM20G45EGH is in a TO-252 package, which is widely used for commercial and industrial surface-mount applications.

The through-hole version, the SSM20G45EGJ in TO-251, is available for vertical mounting, where a small footprint is required on the board, and/or an external heatsink is to be attached.

These devices are manufactured with an advanced process, providing improved on-resistance and switching performance.

The gate has internal ESD protection.

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage | 450 | V |
| $V_{GE}$ | Gate-emitter voltage | ±6 | V |
| $V_{GEP}$ | Pulsed gate-emitter voltage | ±8 | V |
| $I_{CP}$ | Pulsed collector current[1] | 130 | A |
| $P_D$ | Total power dissipation, $T_C$ = 25°C | 20 | W |
| | | | |
| $T_{STG}$ | Storage temperature range | -55 to 150 | °C |
| $T_J$ | Operating junction temperature range | -55 to 150 | °C |

## THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $R_{\Theta JC}$ | Maximum thermal resistance, junction-case | 6 | °C/W |
| | | | |

**Notes:**

1.Pulse width must be limited to avoid exceeding the safe operating area.

2.Pulse width <300us, duty cycle <2%.

## ELECTRICAL CHARACTERISTICS Tj = 25°C (unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_{GES}$ | Gate-emitter leakage current | $V_{GE}$=6V, $V_{CE}$=0V | - | - | 10 | uA |
| $I_{CES}$ | Collector-emitter leakage current | $V_{CE}$=450V, $V_{GE}$=0V | - | - | 10 | uA |
| $V_{CE(sate}$ | Collector-emitter saturation voltage | $V_{GE}$=4.5V, $I_{CP}$=130A (Pulsed) | - | 5 | 8 | V |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE}$=$V_{GE}$, $I_C$=250uA | - | - | 1.2 | V |
| $Q_g$ | Total gate charge | $I_C$=40A | - | 51 | - | nC |
| $Q_{ge}$ | Gate-emitter charge | $V_{CE}$=300V | - | 2 | - | nC |
| $Q_{gc}$ | Gate-collector charge | $V_{GE}$=5V | - | 5.4 | - | nC |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}$=200V | - | 5.5 | - | ns |
| $t_r$ | Rise time | $I_C$=40A | - | 72 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | $R_G$=25Ω | - | 640 | - | ns |
| $t_f$ | Fall fime | $V_{GE}$=5V | - | 2.6 | - | us |
| $C_{ies}$ | Input capacitance | $V_{GE}$=0V | - | 2095 | - | pF |
| $C_{oes}$ | Output capacitance | $V_{CE}$=25V | - | 145 | - | pF |
| $C_{res}$ | Reverse transfer capacitance | f=1.0MHz | - | 35 | - | pF |
| | | | | | | |

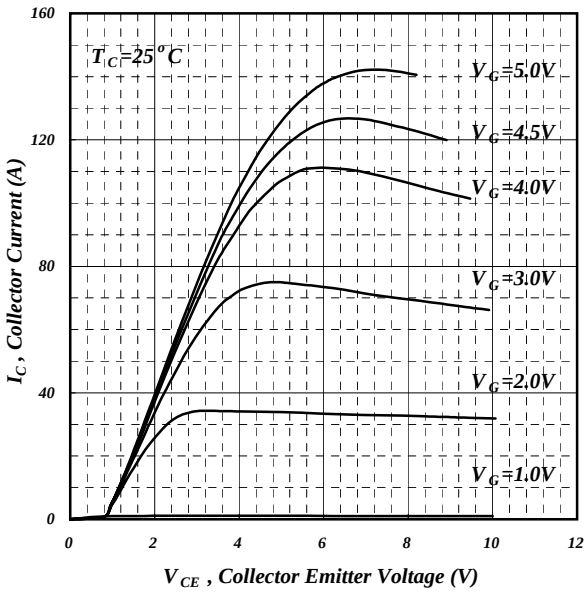



Fig 1. Typical Output Characteristics

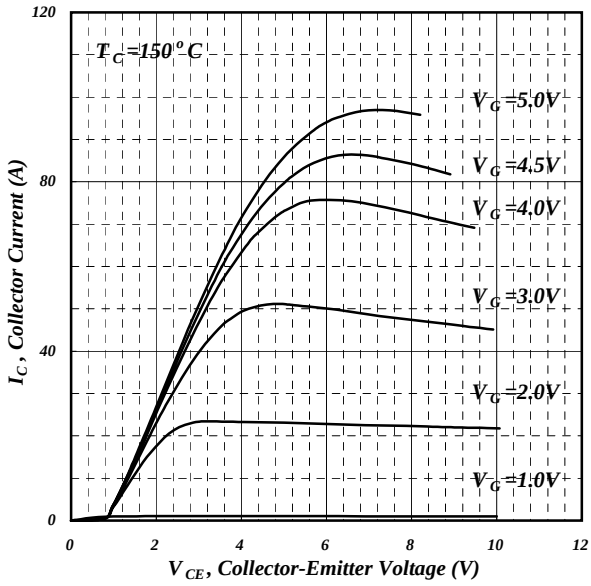



Fig 2. Typical Output Characteristics

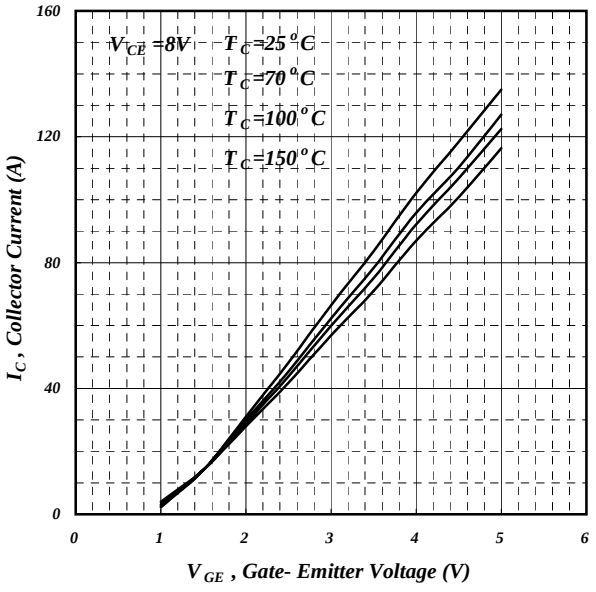



Fig 3. Collector Current vs. Gate-Emitter Voltage

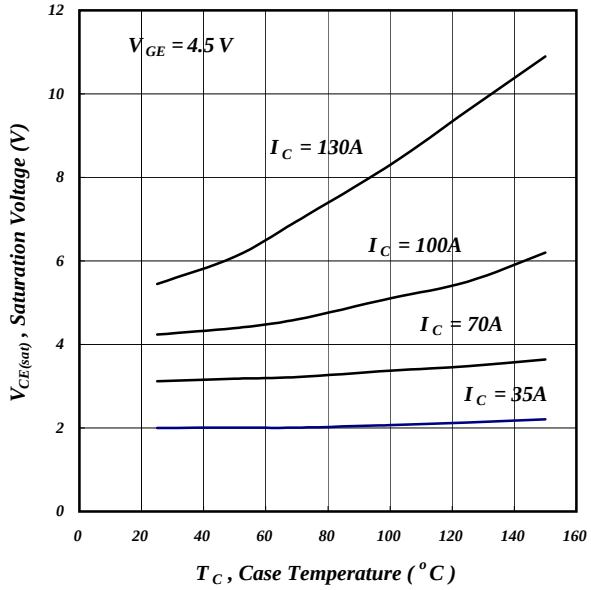



Fig 4. Collector- Emitter Saturation Voltage vs. Case Temperature

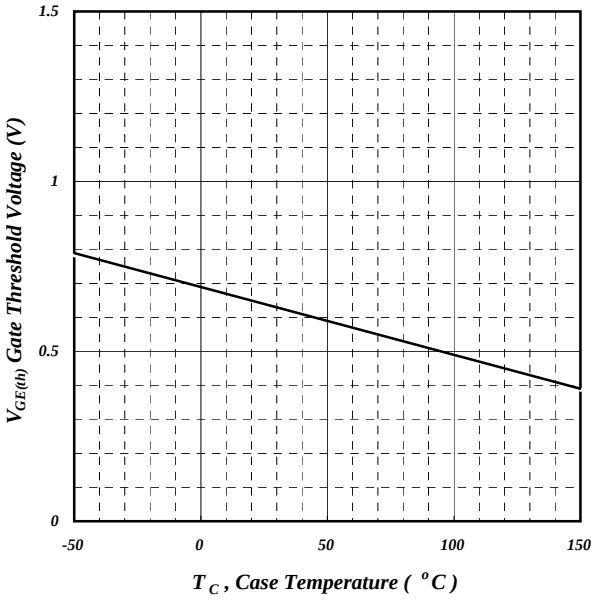



Fig 5. Gate-Emitter Cut-Off Voltage vs. Case Temperature

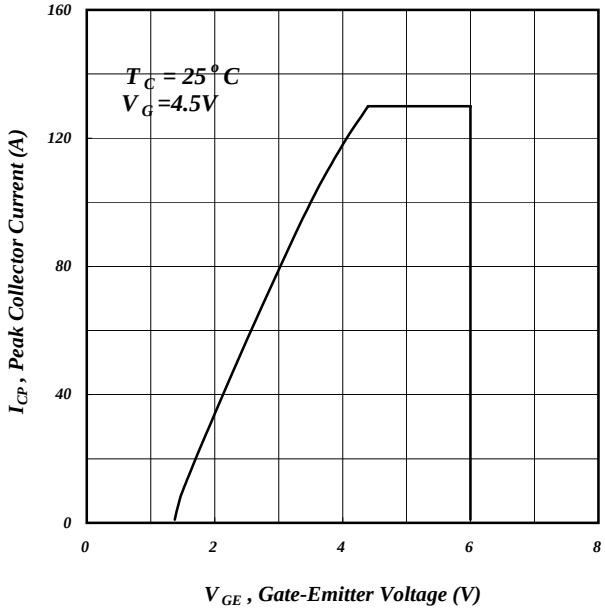



Fig 6. Safe Operating Area

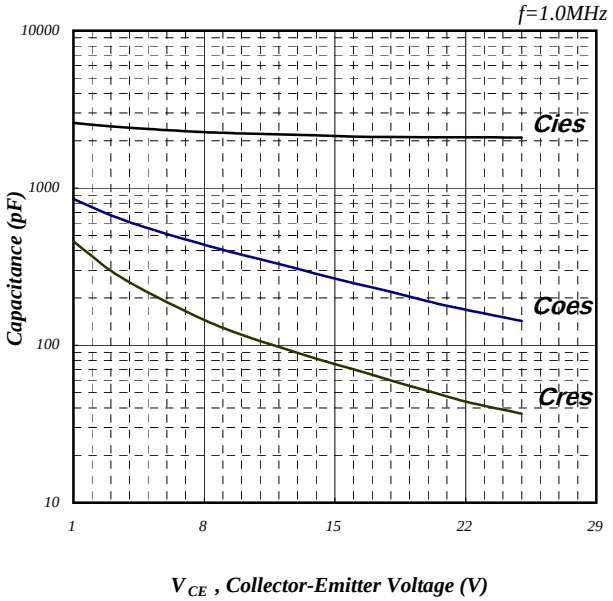



Fig 7. Collector vs. Collector-Emitter Voltage

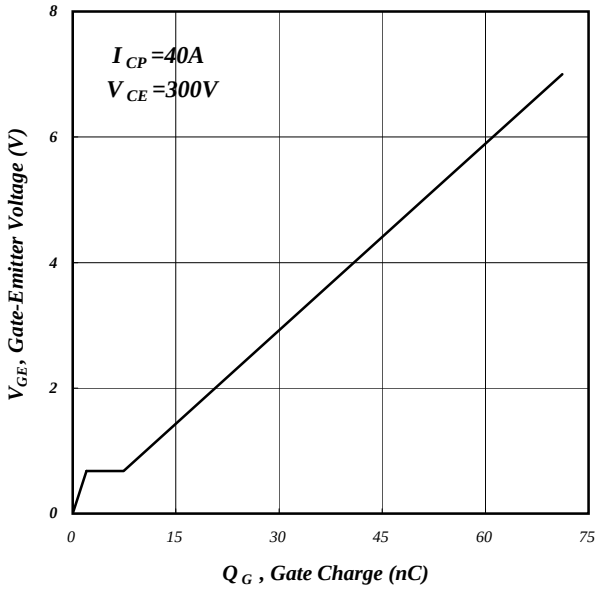



Fig 8. Gate Charge Waveform

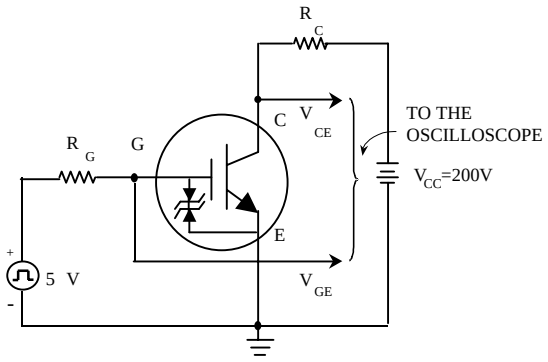



Fig 9. Switching Time Test Circuit

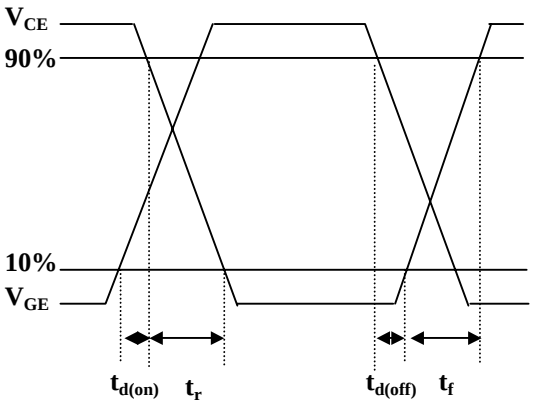



Fig 10. Switching Time Waveform

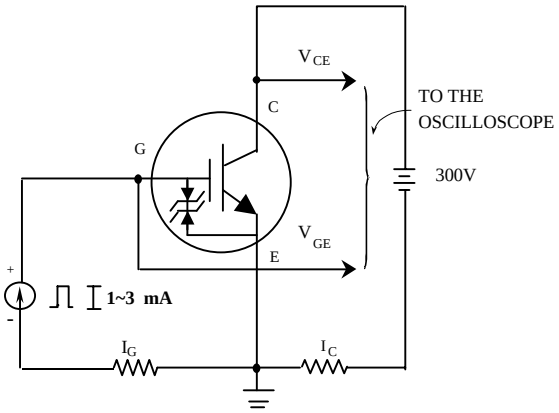



Fig 11. Gate Charge Test Circuit

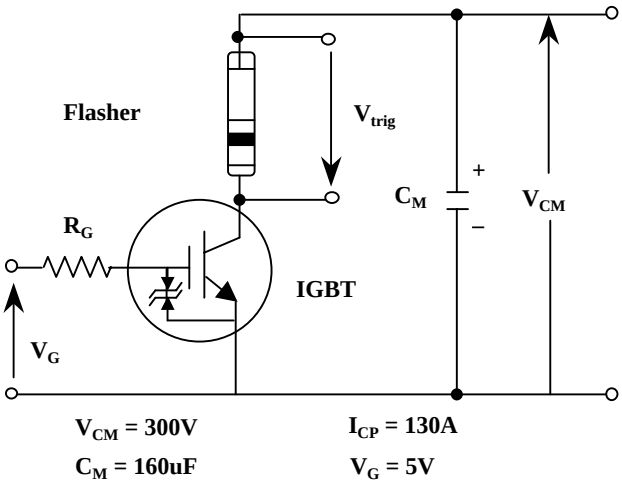
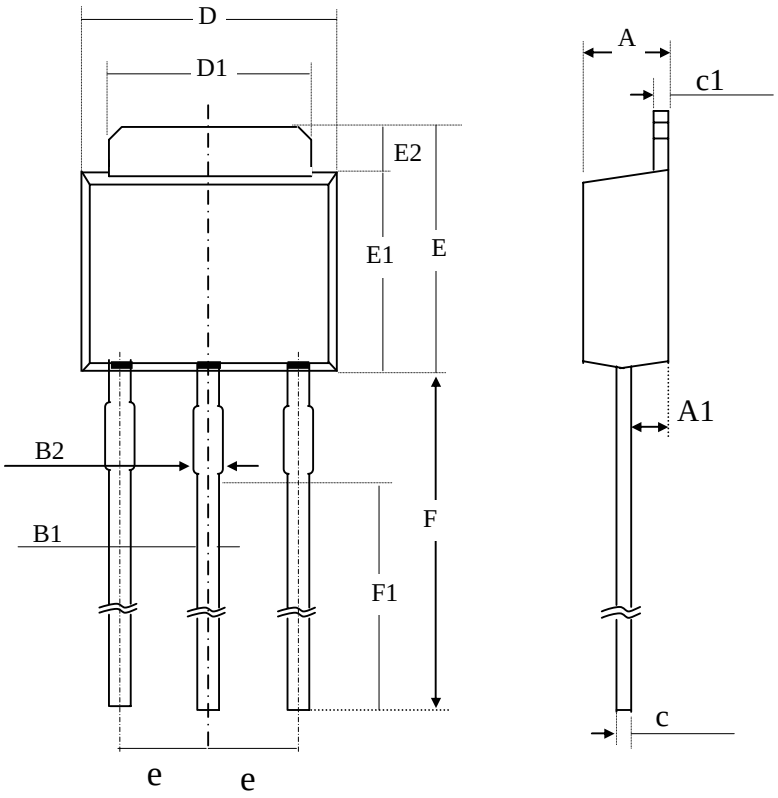



Fig 12. Application Test Circuit

## PHYSICAL DIMENSIONS: TO-251 (I-PAK)

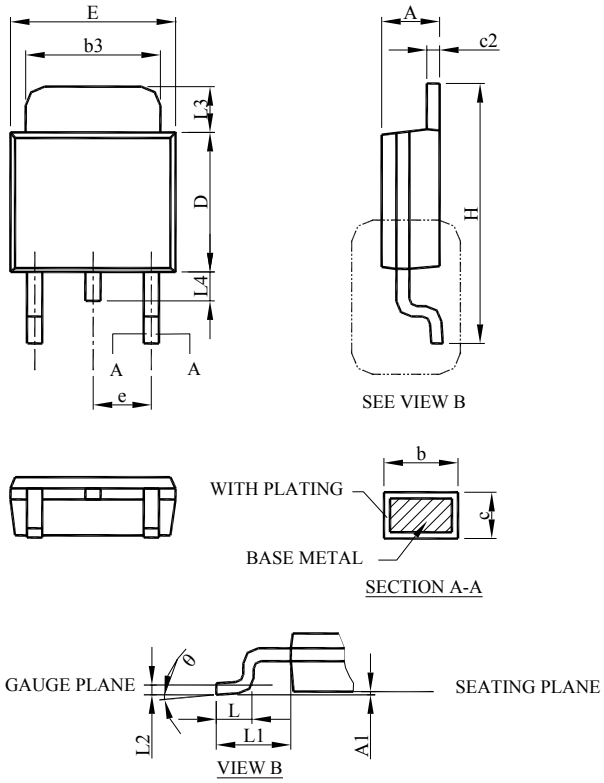



| SYMBOLS | Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0.90 | 1.20 | 1.50 |
| B1 | 0.50 | 0.60 | 0.70 |
| B2 | 0.60 | 0.72 | 0.90 |
| c | 0.45 | 0.50 | 0.60 |
| c1 | 0.45 | 0.50 | 0.55 |
| D | 6.40 | 6.60 | 6.80 |
| D1 | 5.20 | 5.35 | 5.50 |
| E | 6.80 | 7.00 | 7.20 |
| E1 | 5.40 | 5.60 | 5.80 |
| E2 | 1.40 | 1.50 | 1.60 |
| e | -- | 2.30 | -- |
| F | 7.20 | 7.50 | 7.80 |
| F1 | 1.50 | 1.60 | 1.80 |

1.All dimensions are in millimeters.

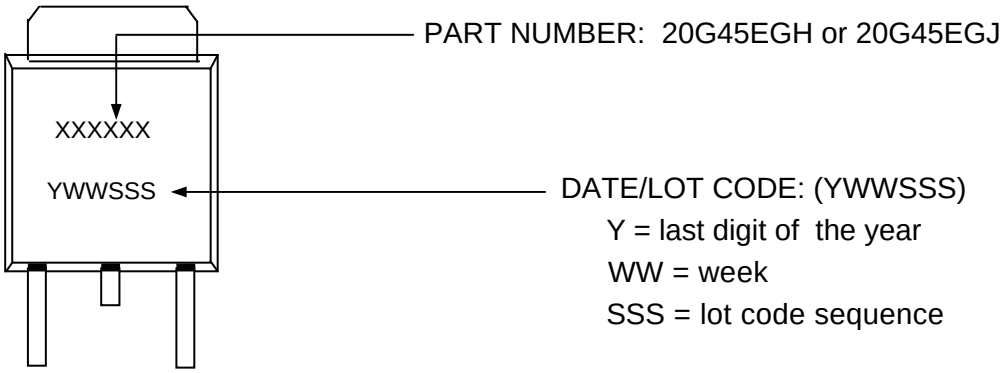
2.Dimensions do not include mold protrusions.

## PHYSICAL DIMENSIONS: TO-252 (D-PAK)




| SYMBOL | TO-252-3L | |
|---|---|---|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | 1.80 | 2.80 |
| A1 | 0.00 | 0.13 |
| b | 0.40 | 1.00 |
| b3 | 4.80 | 5.90 |
| c | 0.35 | 0.65 |
| c2 | 0.40 | 0.89 |
| D | 5.10 | 6.30 |
| E | 6.00 | 7.00 |
| e | 2.30 BSC | |
| H | 7.80 | 11.05 |
| L | 1.00 | 2.55 |
| L1 | 2.20 | 3.05 |
| L2 | 0.35 | 0.65 |
| L3 | 0.50 | 2.03 |
| L4 | 0.50 | 1.20 |
| θ | 0° | 8° |

## PART MARKING




## PACKING: Moisture sensitivity level MSL3

TO-252: 3000 pcs in antistatic tape on a reel packed inside a moisture barrier bag (MBB).
TO-251: 1000pcs in tubes packed inside a moisture barrier bag (MBB).