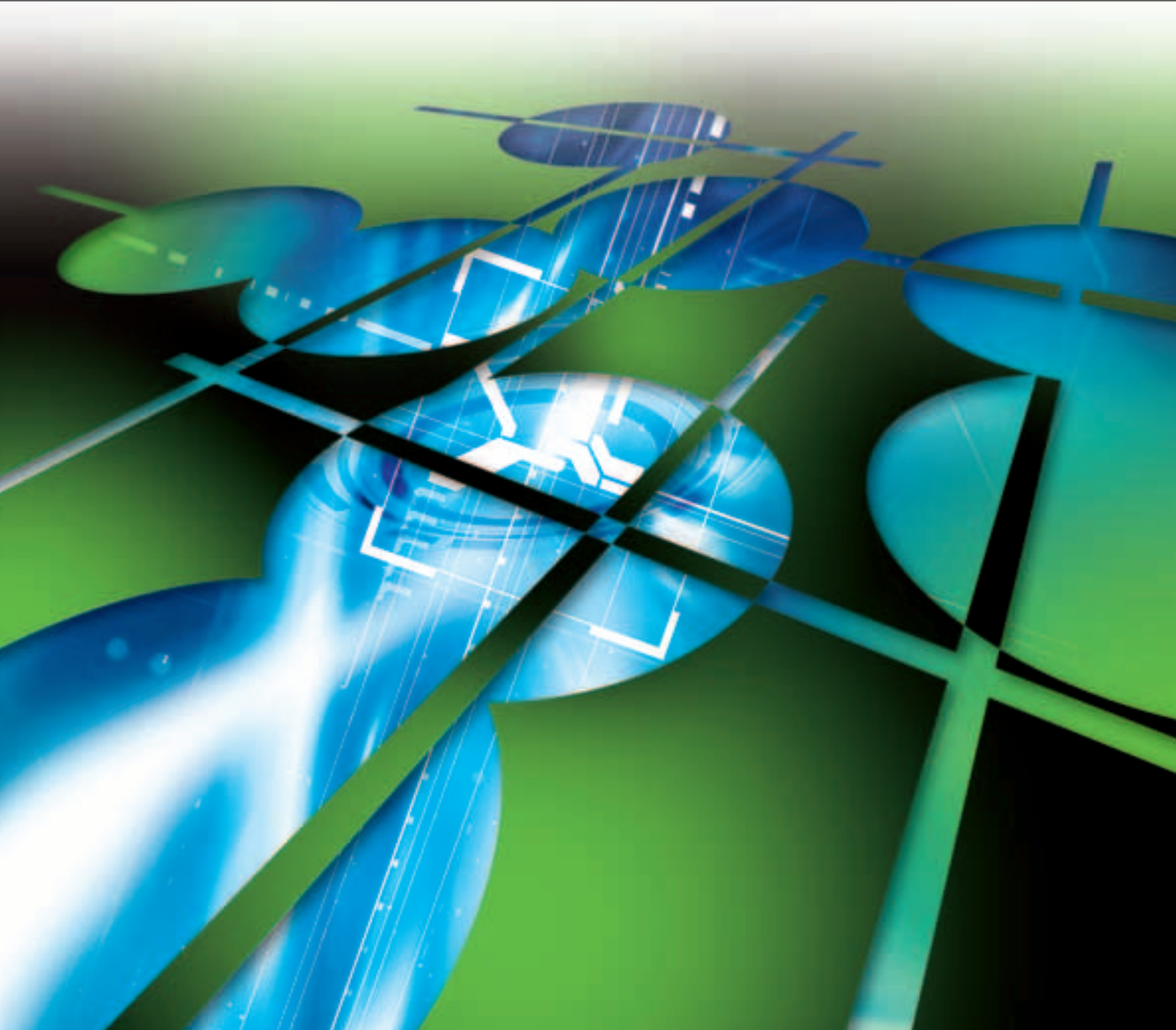


PRODUCT GUIDE

Discrete IGBTs



S E M I C O N D U C T O R

<http://www.semicon.toshiba.co.jp/eng>

1 Features and Structure

IGBT: Insulated Gate Bipolar Transistor

IGBTs combine the MOSFET advantage of high input impedance with the bipolar transistor advantage of high-voltage drive.

The conductivity modulation characteristics of a bipolar transistor make it ideal for load control applications that require high breakdown voltage and high current.

Toshiba offers a family of fast switching IGBTs, which are low in carrier injection and recombination in carrier.

Features of the Toshiba Discrete IGBTs

The Toshiba discrete IGBTs are available in high-voltage and high-current ratings. They are used in inverter and power conversion circuits for such diverse applications as motor drivers, uninterruptible power supply (UPS) systems, IH cookers, plasma display panels (PDPs), strobe flashes and so on.

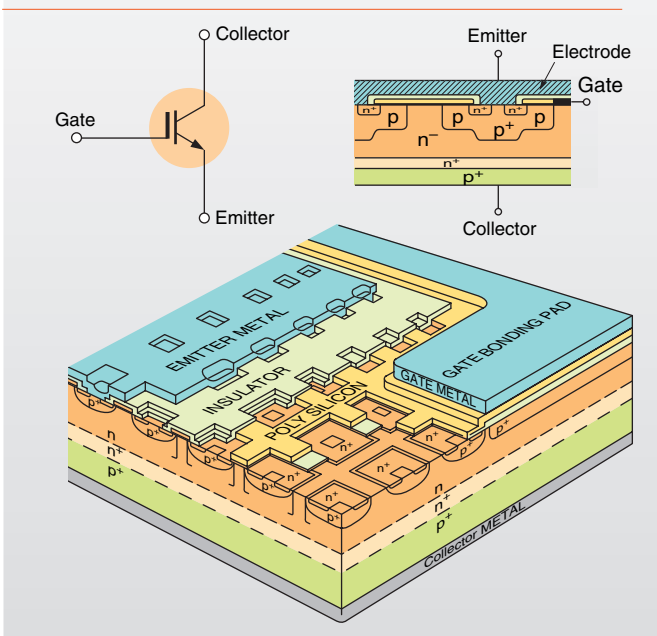
- (1) IGBTs also featuring fast switching
- (2) Low collector-emitter saturation voltage even in the large current area
- (3) IGBTs featuring a built-in diode with optimal characteristics tailored to specific applications
- (4) High input impedance allows voltage drives
- (5) Available in a variety of packages

Construction

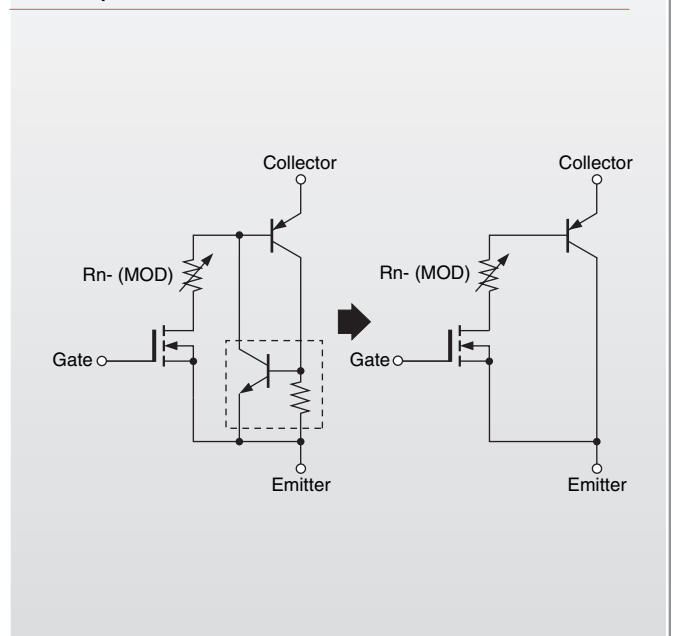
The basic structure of the planar IGBT consists of four layers (pnpn), as shown in the following figure.

Low saturation voltage is achieved by using a pnp transistor to allow conductivity modulation during conduction. Unlike MOSFETs, the IGBT does not have an integral reverse diode, since the collector contact is made on the p⁺ layer.

Planar Structure



Equivalent Circuit



2 IGBT Technical Overview

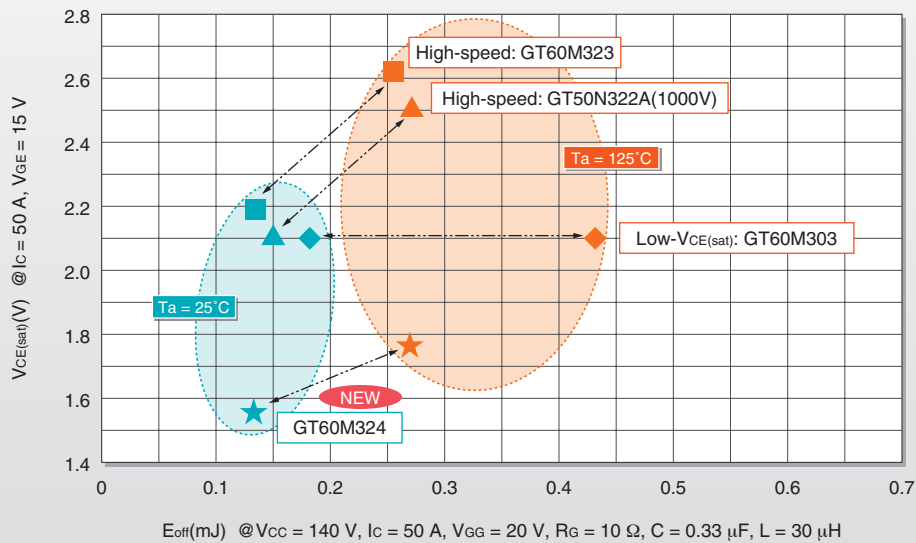
Prior to the development of IGBTs, power MOSFETs were used for power amplifier applications which require high input impedance and fast switching. However, at high voltages, the on-state resistance rapidly increases as the breakdown voltage increases. It is thus difficult to improve the conduction loss of power MOSFETs.

On the other hand, the IGBT structure consists of a pnp bipolar transistor and a collector contact made on the p⁺ layer. The IGBT has a low on-state voltage drop due to conductivity modulation.

The following figure shows the V_{CE(sat)} curve of a soft-switching 900-V IGBT. Toshiba has offered IGBTs featuring fast switching by using carrier lifetime control techniques. Now, Toshiba offers even faster IGBTs with optimized carrier injection into the collector p⁺ layer.

In the future, Toshiba will launch IGBTs with varied characteristics optimized for high-current-conduction and high-frequency-switching applications. The improvements in IGBTs will be spurred by optimized wafers, smaller pattern geometries and improved carrier lifetime control techniques.

▶ 900-V IGBT for Soft-Switching



➤ Discrete IGBT Development Trends

| | |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1200 V | (1) High ruggedness (3rd gen): Low V _{CE(sat)} and high ruggedness due to optimized carrier injection and thinner wafers |
| | (2) Soft switching (5th gen): Low V _{CE(sat)} due to trench gate structure |
| | (3) Soft switching (next gen): Thinner wafers and finer process geometries |
| 900 to 1500 V | (1) Soft switching (4th gen): Low V _{CE(sat)} due to trench gate structure |
| | (2) Soft switching (5th gen): Low V _{CE(sat)} due to optimized carrier injection and trench gate structure |
| | (3) Soft switching (6th gen): Thinner wafers and finer process geometries |
| 600 V | (1) High ruggedness (3rd gen): Low V _{CE(sat)} and high ruggedness due to optimized carrier injection and thinner wafers |
| | (2) Fast switching (4th gen): High speedy tf due to optimized carrier injection |
| | (4) Fast switching (next gen): Thinner wafers and finer process geometries |
| | (3) Soft switching (4th gen): Low V _{CE(sat)} due to trench gate structure |
| | (5) Soft switching (5th gen): Thinner wafers and finer process geometries |
| 400 V | (1) Strobe flashes (5th gen): Low V _{CE(sat)} due to trench gate structure |
| | (2) Strobe flashes (6th gen): High current due to trench gate structure and optimized wafers |
| | (3) Strobe flashes (7th gen): High current due to optimized wafers and finer process geometries |
| 300 to 400 V | (1) Plasma displays (4th gen): Low V _{CE(sat)} due to trench gate structure and high IC due to lifetime control |
| | (2) Plasma displays (5th gen): Low turn-on loss due to finer process geometries |
| | (3) Plasma displays (6th gen): Low turn-on loss due to optimized wafers and finer process geometries |
| Year | 2006 → 2008 → 2010 → 2012 → |

3 Discrete IGBT Product List

| Applications and Features | Breakdown Voltage V_{CES} (V) @ $T_a = 25^\circ\text{C}$ | IGBT Current Rating I_c (A) @ $T_a = 25^\circ\text{C}$ | | TSON-8 | TSSOP-8 | SOP-8 | TO-220NIS | TO-220SIS | TO-220SM | TO-3P(N) | TO-3P(N)IS | TO-3P(LH) |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------|-----------------------------------|----------|----------------------------------|----------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|---------------------------------|------------------------------------------------------------|
| | | DC | Pulse | | | | | | | | | |
| | | General-purpose motors General-purpose inverters Hard switching fc: up to 20 kHz High ruggedness Series | 600 | 5 10 15 20 30 50 | 10 20 30 40 60 100 | | | | GT5J301 GT10J303 GT15J301 | | GT5J311 GT10J312 GT15J311 | GT10J301 GT20J301 GT20J101 GT30J301 GT30J101 |
| General-purpose inverters Fast switching Hard switching fc: up to 50 kHz FS series | 600 | 10 15 20 30 50 | 20 30 40 60 100 | | | | GT10J321 GT15J321 GT20J321 | | | GT30J324 GT30J121 | GT30J126 | GT50J325 GT50J121 |
| General-purpose inverters Low- $V_{CE(sat)}$ IGBT | 600 | 15 | 30 | | | | | | GT15J331 | | | |
| Resonant switching Soft switching Soft-Switching Series | 600 | 30 40 50 60 | 100 100 100 120 | | | | | | | GT40J321 GT40J322 GT50J327 GT50J328 | GT30J322 | GT50J322 GT50J322H GT60J321 GT60J323 GT60J323H |
| | 900 | 15 50 60 | 30 120 120 | | | | | | | GT50M322 GT60M324 | GT15M321 | GT60M303 GT60M323 |
| | 1000 | 50 57 60 | 120 120 120 | | | | | | | GT50N322A GT50N324 | | GT60N322 GT60N321 |
| | 1200 | 42 | 80 | | | | | | | GT40Q321 | | |
| | 1500 | 40 | 80 | | | | | | | GT40T321 | | GT40T302 |
| PFC | 600 | 30 | 100 | | | | | | | | GT30J122 | |
| Strobe flashes | 400 | 130 150 200 | | GT5G133 | GT8G133 GT8G134 GT8G136 | GT8G132 | | | | | | |
| | | 120 | | | | GT10G131 | | | | | | |
| Plasma display panels | 300 | 200 | | | | | | GF30F122 GF30F123 GT30F124 GT45F122 GT45F123 GT45F124 GT45F125 GT45F127 | GT45F131 | | | |
| | 330 | 200 | | | | | | GT30F125 GT45F128 GT30G122 | | | | |
| | 400 | 120 200 | | | | | | GT45G122 GT45G123 GT45G124 GT45G125 | GT45G131 | | | |
| | 430 | 200 | | | | | | GT30G123 GT30G124 GT30G125 GT45G127 GT45G128 | | | | |
| | 600 | 200 | | | | | | GT30J124 | | | | |

 : New product

4 Part Numbering Scheme

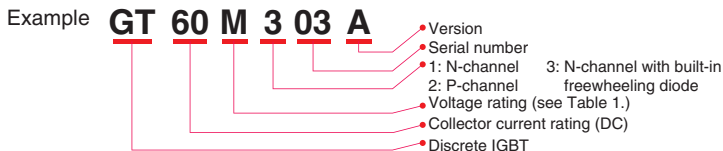


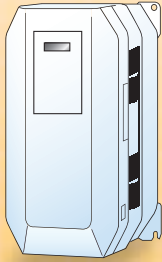
Table 1

| Letter | Voltage (V) | Letter | Voltage (V) | Letter | Voltage (V) |
|--------|-------------|--------|-------------|--------|-------------|
| C | 150 | J | 600 | Q | 1200 |
| D | 200 | K | 700 | R | 1300 |
| E | 250 | L | 800 | S | 1400 |
| F | 300 | M | 900 | T | 1500 |
| G | 400 | N | 1000 | U | 1600 |
| H | 500 | P | 1100 | V | 1700 |

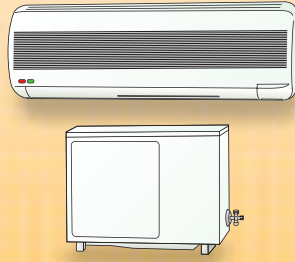
5-1 General-Purpose Inverter

The fast-switching (FS) series, a new addition to our third-generation IGBTs, features high ruggedness which helps to improve the energy efficiency of electronic equipment.

General-Purpose Inverters



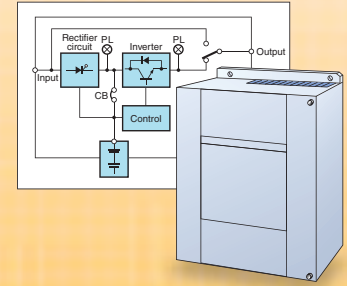
Inverter Air Conditioners



Inverter Washing Machines



UPS



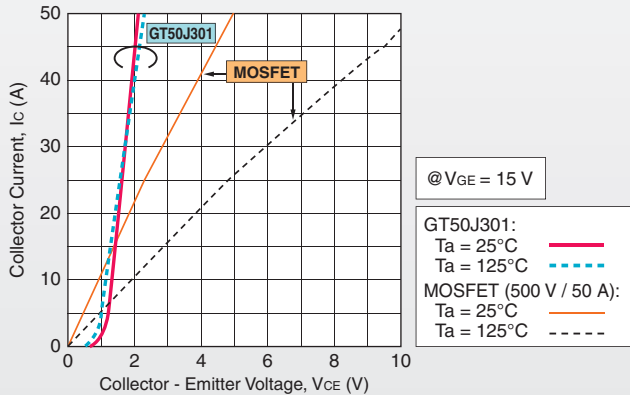
Discrete IGBT Trend

► For general-purpose inverters

Our 3rd generation low-loss and low-noise IGBTs are ideal for inverter applications to reduce switching loss and thus improve energy efficiency. The following graphs compare the thermal and turn-on characteristics of our 3rd generation IGBTs and 500-V MOSFETs

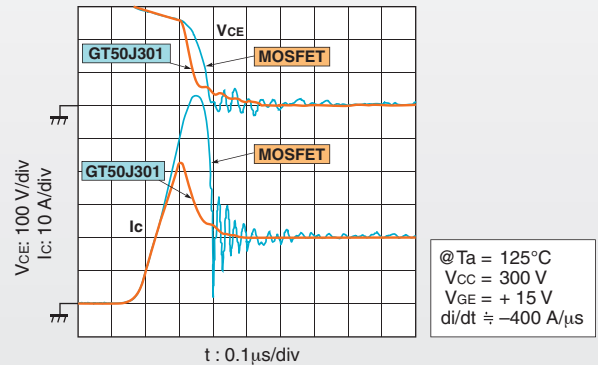
► IC - V_{CE} Temperature Characteristics

Low saturation voltage with minimal temperature dependence



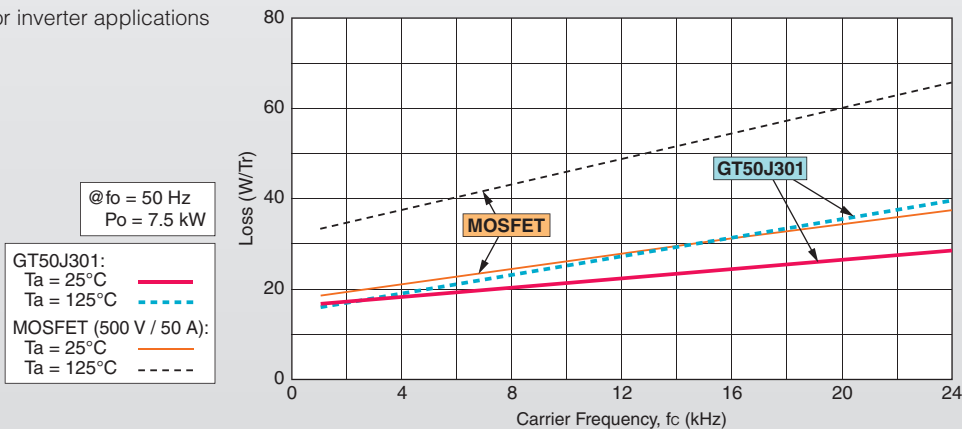
► Turn-On Waveform

Fast reverse-recovery characteristics due to built-in diode with optimal characteristics



► Power Loss vs. Carrier Frequency Characteristics

Simulation data for inverter applications



5-1 General-Purpose Inverter

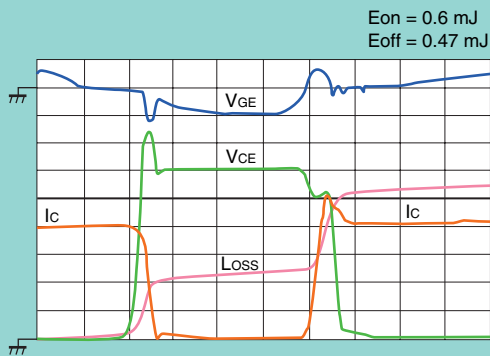
Fast-Switching (FS) Series

► For general-purpose inverters

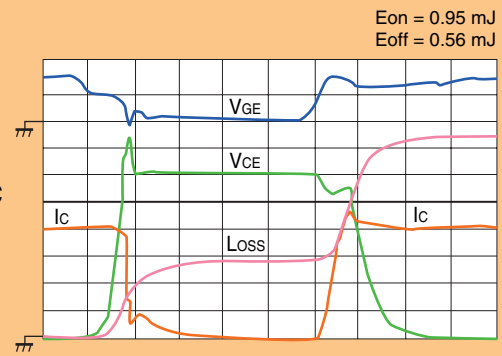
Compared to the third-generation highly rugged series, the FS series is optimized for switching speed, reducing the total switching loss ($E_{on} + E_{off}$) by 30% (according to Toshiba's comparative test).

► Typical Waveforms

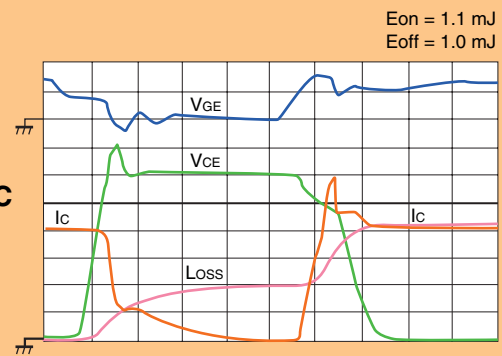
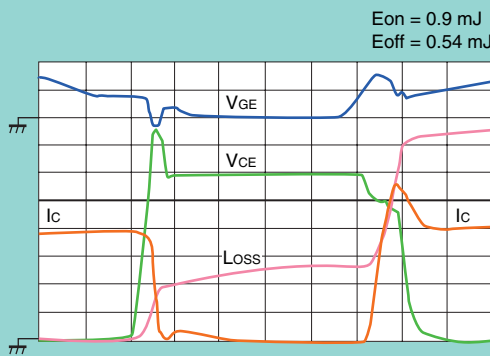
GT20J321(4th generation, FS Series)



GT20J301(3rd generation)



$T_a = 25^\circ\text{C}$



$T_a = 125^\circ\text{C}$

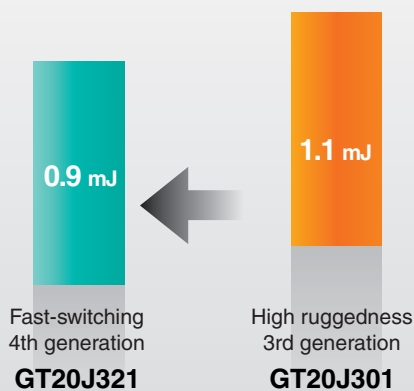
(Loss: 0.5 mJ/div)

(V_{CE} : 50 V/div, I_c : 5 A/div, V_{GE} : 10 V/div, Loss: 0.2 mJ/div, t : 0.2 μs /div)

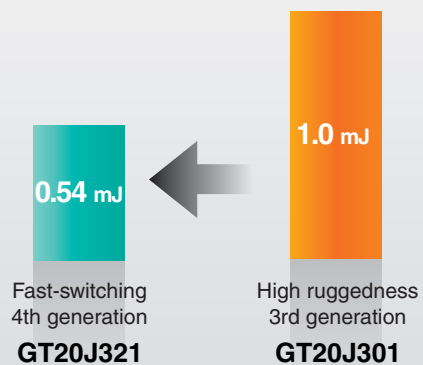
Reduced switching loss of fast-switching IGBTs in comparison with high ruggedness IGBTs

Test condition: $I_C = 20 \text{ A}$, $V_{GE} = 15 \text{ V}$, $R_G = 33 \Omega$, $T_a = 125^\circ\text{C}$, with inductive load, $V_{CC} = 300 \text{ V}$

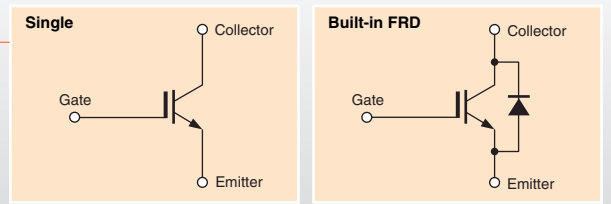
► Turn-On Loss



► Turn-Off Loss



► Circuit Configurations



► 600-V and 1200-V IGBTs (3rd Generation)

| Main Applications | Features | Part Number | Absolute Maximum Ratings | | | | Package | Circuit Configuration (*1) | VCE(sat) Typ. | | | tr Typ. | | Remarks | |
|-------------------------|-------------------------|-------------|--------------------------|--------|------------|-----|--------------|----------------------------|---------------|-----------|------|-----------|---------------|---------|-----------------------------|
| | | | VCEs (V) | Ic | | Pc | | | @ Ic (A) | @ VGE (V) | (μs) | Load (*2) | | | |
| | | | | DC (A) | Pulsed (A) | | | | | | | | Tc = 25°C (W) | | |
| Motor driving (UPS/PFC) | High VCEs (1200V) | GT10Q101 | 1200 | 10 | 20 | 140 | TO-3P(N) | ◆ | 2.1 | 10 | 15 | 0.16 | L | | |
| | | GT10Q301 | 1200 | 10 | 20 | 140 | TO-3P(N) | – | Built-in FRD | 2.1 | 10 | 15 | 0.16 | L | |
| | | GT15Q102 | 1200 | 15 | 30 | 170 | TO-3P(N) | – | ◆ | 2.1 | 15 | 15 | 0.16 | L | |
| | | GT15Q301 | 1200 | 15 | 30 | 170 | TO-3P(N) | – | Built-in FRD | 2.1 | 15 | 15 | 0.16 | L | |
| | | GT25Q102 | 1200 | 25 | 50 | 200 | TO-3P(LH) | – | ◆ | 2.1 | 25 | 15 | 0.16 | L | |
| | | GT25Q301 | 1200 | 25 | 50 | 200 | TO-3P(LH) | – | Built-in FRD | 2.1 | 25 | 15 | 0.16 | L | |
| | High VCEs (600V) | GT5J301 | 600 | 5 | 10 | 28 | TO-220NIS | – | Built-in FRD | 2.1 | 5 | 15 | 0.15 | L | |
| | | GT5J311 | 600 | 5 | 10 | 45 | TO-220SM | SMD | Built-in FRD | 2.1 | 5 | 15 | 0.15 | L | |
| | | GT10J301 | 600 | 10 | 20 | 90 | TO-3P(N) | – | Built-in FRD | 2.1 | 10 | 15 | 0.15 | L | |
| | | GT10J303 | 600 | 10 | 20 | 30 | TO-220NIS | – | Built-in FRD | 2.1 | 10 | 15 | 0.15 | L | |
| | | GT10J312 | 600 | 10 | 20 | 60 | TO-220SM | SMD | Built-in FRD | 2.1 | 10 | 15 | 0.15 | L | |
| | | GT15J301 | 600 | 15 | 30 | 35 | TO-220NIS | – | Built-in FRD | 2.1 | 15 | 15 | 0.15 | L | |
| | | GT15J311 | 600 | 15 | 30 | 70 | TO-220SM | SMD | Built-in FRD | 2.1 | 15 | 15 | 0.15 | L | |
| | | GT20J101 | 600 | 20 | 40 | 130 | TO-3P(N) | – | ◆ | 2.1 | 20 | 15 | 0.15 | L | |
| | | GT20J301 | 600 | 20 | 40 | 130 | TO-3P(N) | – | Built-in FRD | 2.1 | 20 | 15 | 0.15 | L | |
| | | GT30J101 | 600 | 30 | 60 | 155 | TO-3P(N) | – | ◆ | 2.1 | 30 | 15 | 0.15 | L | |
| | | GT30J301 | 600 | 30 | 60 | 155 | TO-3P(N) | – | Built-in FRD | 2.1 | 30 | 15 | 0.15 | L | |
| | | GT50J102 | 600 | 50 | 100 | 200 | TO-3P(LH) | – | ◆ | 2.1 | 50 | 15 | 0.15 | L | |
| GT50J301 | 600 | 50 | 100 | 200 | TO-3P(LH) | – | Built-in FRD | 2.1 | 50 | 15 | 0.15 | L | | | |
| Power factor correction | Low-frequency switching | GT30J122 | 600 | 30 | 100 | 75 | TO-3P(N)IS | – | ◆ | 2.1 | 50 | 15 | 0.25 | R | Partial Switching Converter |

► 600-V Fast-Switching IGBTs (4th Generation)

(FS: Fast Switching)

| Main Applications | Features | Part Number | Absolute Maximum Ratings | | | | Package | Circuit Configuration (*1) | VCE(sat) Typ. | | | tr Typ. | | Remarks | |
|-----------------------------------------|----------------|-------------|--------------------------|--------|------------|-----|------------|----------------------------|---------------|-----------|------|-----------|---------------|---------|-------------------|
| | | | VCEs (V) | Ic | | Pc | | | @ Ic (A) | @ VGE (V) | (μs) | Load (*2) | | | |
| | | | | DC (A) | Pulsed (A) | | | | | | | | Tc = 25°C (W) | | |
| Inverter power supplies (UPS/PFC/motor) | Fast switching | GT10J321 | 600 | 10 | 20 | 29 | TO-220NIS | – | Built-in FRD | 2.0 | 10 | 15 | 0.03 | L | |
| | | GT15J321 | 600 | 15 | 30 | 30 | TO-220NIS | – | Built-in FRD | 1.9 | 15 | 15 | 0.03 | L | |
| | | GT15J331 | 600 | 15 | 30 | 70 | TO-220SM | SMD | Built-in FRD | 1.75 | 15 | 15 | 0.10 | L | Low VCE(sat) |
| | | GT20J321 | 600 | 20 | 40 | 45 | TO-220NIS | – | Built-in FRD | 2.0 | 20 | 15 | 0.04 | L | |
| | | GT30J121 | 600 | 30 | 60 | 170 | TO-3P(N) | – | ◆ | 2.0 | 30 | 15 | 0.05 | L | |
| | | GT30J126 | 600 | 30 | 60 | 90 | TO-3P(N)IS | – | ◆ | 1.95 | 30 | 15 | 0.05 | L | Isolation Package |
| | | GT30J324 | 600 | 30 | 60 | 170 | TO-3P(N) | – | Built-in FRD | 2.0 | 30 | 15 | 0.05 | L | |
| | | GT50J121 | 600 | 50 | 100 | 240 | TO-3P(LH) | – | ◆ | 2.0 | 50 | 15 | 0.05 | L | |
| | | GT50J325 | 600 | 50 | 100 | 240 | TO-3P(LH) | – | Built-in FRD | 2.0 | 50 | 15 | 0.05 | L | |

*1 ◆ : Single
FRD: Fast Recovery Diode
*2 R : Resistive load
L : Inductive load

5-2 Soft-Switching Applications

Static inverters in IH cooktops, IH rice cookers and microwave ovens utilize a soft-switching technique which exhibits low switching loss. Toshiba offers IGBTs suitable for soft-switching applications.

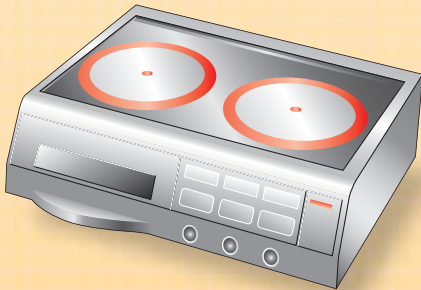
Microwave Ovens



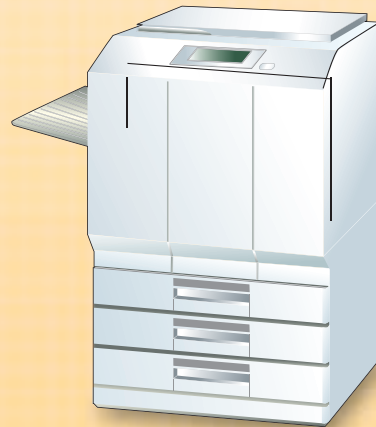
IH Rice Cookers



IH Cookers



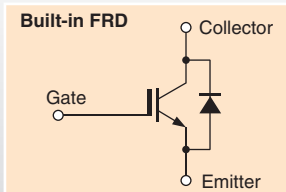
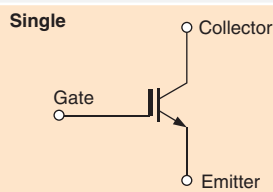
MFPs



| AC Input Voltage | Circuit | IGBT Rating | |
|------------------|--------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------|
| 100 V to 120 V | <p>Voltage Resonance</p> | <p>Waveform</p> | <p>$V_{CES} = 900 \text{ V to } 1000 \text{ V}$ $I_c = 15 \text{ A to } 60 \text{ A}$</p> |
| 200 V to 240 V | | | <p>$V_{CES} = 1200 \text{ V to } 1500 \text{ V}$ $I_c = 40 \text{ A}$</p> |
| 100 V to 240 V | <p>Current Resonance</p> | <p>Waveform</p> | <p>$V_{CES} = 400 \text{ V}$ $I_c = 40 \text{ A to } 50 \text{ A}$</p> |
| | | | <p>$V_{CES} = 600 \text{ V}$ $I_c = 30 \text{ A to } 80 \text{ A}$</p> |

IH: Induction heating
MFP: Multifunction Printer

► Circuit Configurations



► IGBTs for Soft-Switching Applications

| Main Applications | Features | Part Number | Absolute Maximum Ratings | | | | Package | Circuit Configuration (*1) | VCE(sat) Typ. | | | tr Typ. | | Remarks | | |
|---------------------------------|----------|-------------------|--------------------------|--------|------------|---------------------|---------|----------------------------|---------------|------------|---------|----------|------|------------|----------------|----------------|
| | | | VCES (V) | Ic | | Pc Tc = 25°C (W) | | | Tj (°C) | V | @Ic (A) | @VGE (V) | μs | | Load (*2) | |
| | | | | DC (A) | Pulsed (A) | | | | | | | | | | | |
| IH rice cookers and IH cooktops | AC 200 V | Current resonance | 600 | 30 | 100 | 75 | 150 | TO-3P(N)IS | Built-in FRD | 2.1 | 50 | 15 | 0.25 | R | | |
| | | | | 40 | 100 | 120 | 150 | TO-3P(N) | | 2.0 | 40 | 15 | 0.11 | | Fast switching | |
| | | | | 40 | 100 | 120 | 150 | TO-3P(LH) | | 1.7 | 40 | 15 | 0.2 | | | |
| | | | | 50 | 100 | 130 | 150 | | | 2.1 | 50 | 15 | 0.25 | | | |
| | | | | 50 | 100 | 130 | 150 | TO-3P(N) | | 2.2 | 50 | 15 | 0.11 | | Fast switching | |
| | | | | 50 | 100 | 140 | 150 | | | 1.9 | 50 | 15 | 0.19 | | | |
| | | | | 50 | 120 | 140 | 150 | TO-3P(LH) | | 2.0 | 50 | 15 | 0.10 | | Fast switching | |
| | | | | 60 | 120 | 200 | 150 | | | 1.55 | 60 | 15 | 0.30 | | | |
| | | | | 60 | 120 | 170 | 150 | TO-3P(LH) | | 1.9 | 60 | 15 | 0.16 | | | |
| | | | | 60 | 120 | 170 | 150 | | | 2.1 | 60 | 15 | 0.12 | | Fast switching | |
| | AC 100 V | Voltage resonance | 900 | 1000 | 15 | 30 | 55 | 150 | | TO-3P(N)IS | 1.8 | 15 | 15 | | 0.20 | |
| | | | | | 50 | 120 | 156 | 150 | | TO-3P(N) | 2.1 | 60 | 15 | | 0.25 | |
| | | | | | 60 | 120 | 170 | 150 | | TO-3P(LH) | 2.1 | 60 | 15 | | 0.25 | |
| | | | | | 60 | 120 | 200 | 150 | | | 2.3 | 60 | 15 | | 0.09 | Fast switching |
| | | | | | 60 | 120 | 254 | 175 | | TO-3P(N) | 1.7 | 60 | 15 | | 0.11 | Tj = 175°C |
| | | | | | 50 | 120 | 156 | 150 | | | 2.5 | 60 | 15 | | 0.25 | |
| | | | | | 50 | 120 | 156 | 150 | | TO-3P(LH) | 2.2 | 60 | 15 | | 0.10 | Fast switching |
| | | | | | 50 | 120 | 150 | 150 | | | 1.9 | 60 | 15 | | 0.11 | 6th generation |
| | | | | | 60 | 120 | 170 | 150 | | TO-3P(LH) | 2.3 | 60 | 15 | | 0.25 | |
| | | | | | 57 | 120 | 200 | 150 | | | 2.4 | 60 | 15 | | 0.11 | Fast switching |
| AC 200 V | | | 1200 | 1500 | 42 | 80 | 170 | 150 | TO-3P(N) | 2.8 | 40 | 15 | 0.41 | | | |
| | | | | | 40 | 80 | 230 | 175 | TO-3P(LH) | 2.15 | 40 | 15 | 0.24 | Tj = 175°C | | |
| | | | | | 40 | 80 | 200 | 150 | | 3.7 | 40 | 15 | 0.23 | | | |

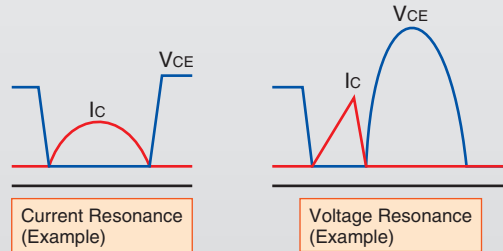
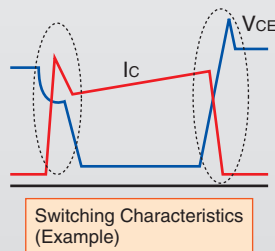
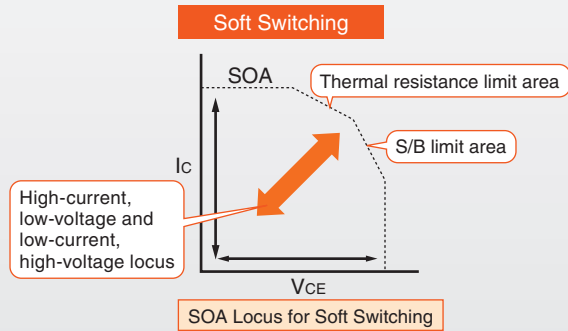
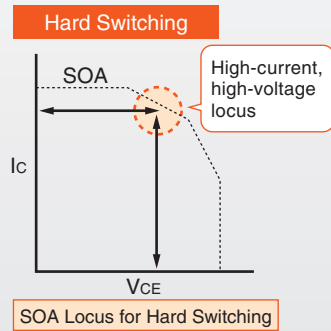
*1 FRD: Fast Recovery Diode

*2 R : Resistive load

■ : New product

5-2 Soft-Switching Applications

► Comparisons Between Hard and Soft Switching (diagrams shown only as a guide)

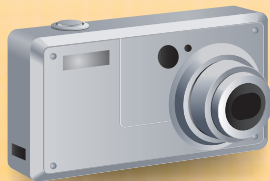


5-3 Strobe Flash Applications

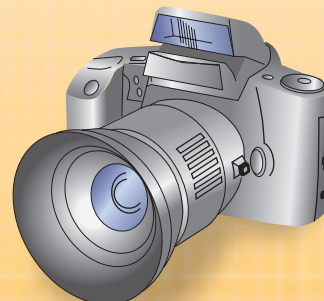
Strobe flash control is now prevalent in digital still cameras. Package sizes are getting smaller, and logic levels are increasingly used to represent the gate drive voltage. Toshiba offers compact IGBTs featuring low gate drive voltage.

- As a voltage-controlled device, the IGBT requires only a few components for drive circuit.
- IGBTs require fewer components for the strobe flash circuit (compared to SCRs).
- Strobe flash IGBTs are capable of switching large currents.

DSC, Compact Camera



Single-Lens Reflex Camera



5-3 Strobe Flash Applications

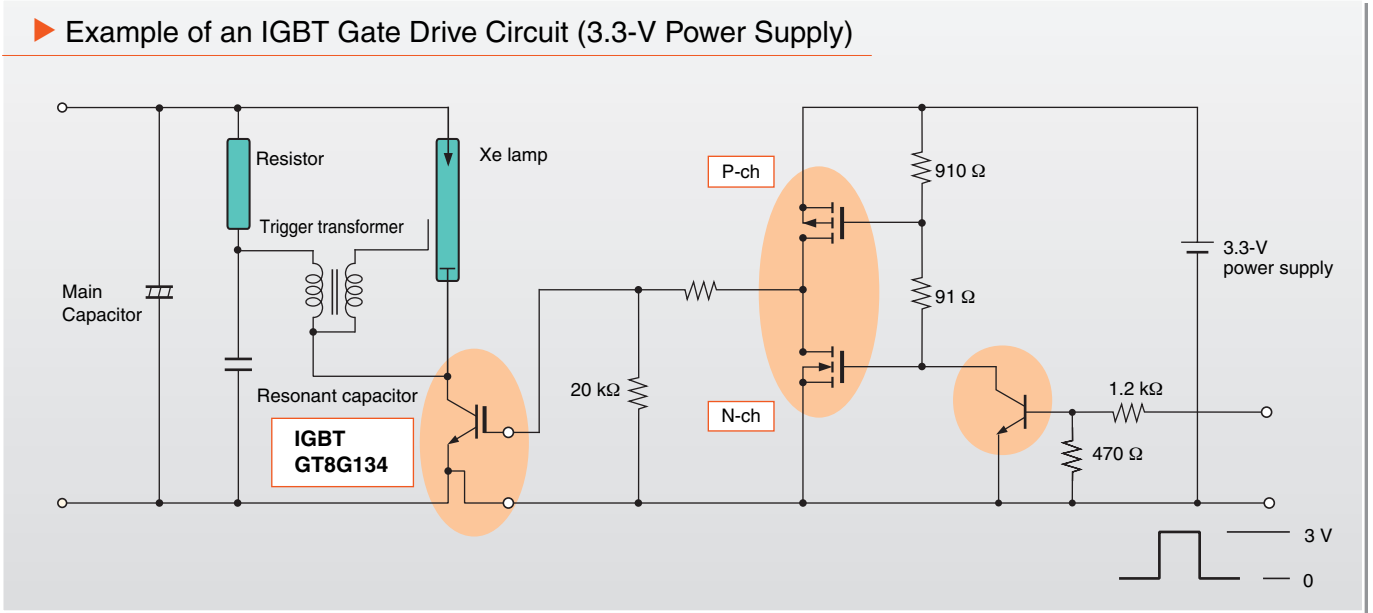
Product List

► For strobe flashes

2.5-V to 4.0-V Gate Drive Series

The IGBT can operate with a gate drive voltage of 2.5 V to 4.0 V. The common 3.3-V or 5-V internal power supply in a camera can be used as a gate drive power supply to simplify the power supply circuitry. A zener diode is included between the gate and emitter to provide ESD surge protection.

► Example of an IGBT Gate Drive Circuit (3.3-V Power Supply)



3.3-V Power Supply

| Part Number | V _{CE(sat)} / I _c | Gate Drive Voltage Min (V) | V _{CE(sat)} (V) | | P _c (W) @ Ta = 25°C | Package | Board Connection | Remarks |
|-------------|---------------------------------------|----------------------------|--------------------------|----------------------------------|--------------------------------|---------|------------------|----------------|
| | | | Typ. | V _{GE} / I _c | | | | |
| GT5G133 | 400 V / 130 A | 2.5 | 3.0 | 2.5 V / 130 A | 0.83 | TSON-8 | 1 | 7th generation |
| GT8G136 | 400 V / 150 A | 3 | 3.5 | 3 V / 150 A | 1.1 | TSSOP-8 | 2 | 5th generation |
| GT8G134 | 400 V / 150 A | 2.5 | 3.4 | 2.5 V / 150 A | 1.1 | TSSOP-8 | 2 | 6th generation |

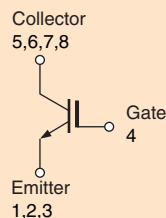
■ : New product

5-V Power Supply

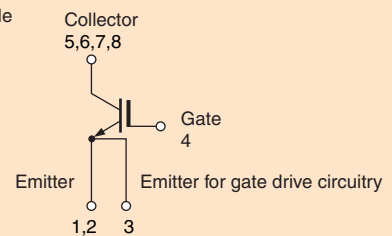
| Part Number | V _{CE(sat)} / I _c | Gate Drive Voltage Min (V) | V _{CE(sat)} (V) | | P _c (W) @ Ta = 25°C | Package | Board Connection | Remarks |
|-------------|---------------------------------------|----------------------------|--------------------------|----------------------------------|--------------------------------|---------|------------------|----------------|
| | | | Typ. | V _{GE} / I _c | | | | |
| GT8G132 | 400 V / 150 A | 4.0 | 2.3 | 4.0 V / 150 A | 1.1 | SOP-8 | 1 | 5th generation |
| GT8G133 | 400 V / 150 A | 4.0 | 2.9 | 4.0 V / 150 A | 1.1 | TSSOP-8 | 1 | 5th generation |
| GT10G131 | 400 V / 200 A | 4.0 | 2.3 | 4.0 V / 200 A | 1.9 | SOP-8 | 1 | 5th generation |

<Connection Examples>

1: Board connection example



2: Board connection example



All the emitter terminals should be connected together.

5-4 Plasma Display Panel Applications

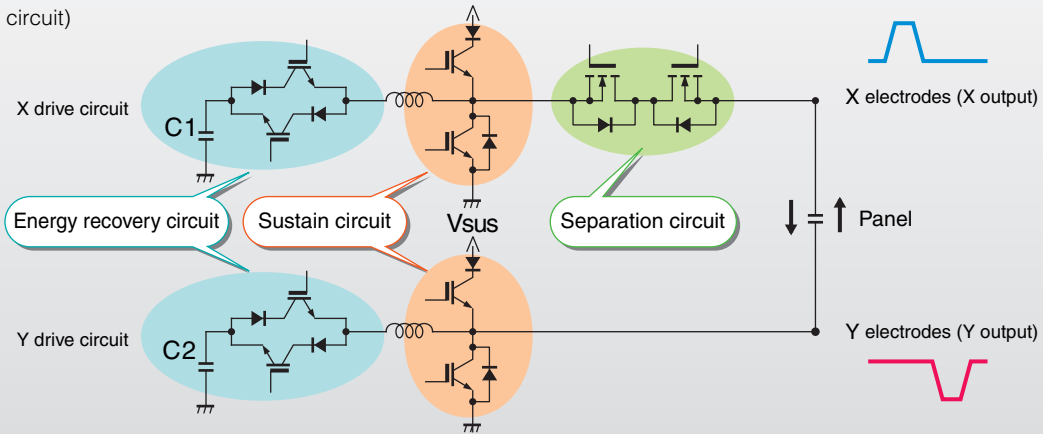
Plasma Displays

Parallel MOSFETs have been used for the drive circuitry of plasma display panels (PDPs). Recently, however, IGBTs are commonly used in large current applications due to their superior current conduction capability.



Example of a Plasma Display Panel Drive Circuit

PDP (Sustain circuit)



Product List

► For plasma display panels

300-V IGBTs

| Part Number | V _{CE(S)} / I _{CP} @ 3 μs | V _{CE(sat)} (V) Typ. @ 120 A | P _C (W) @ T _C = 25 °C | Package | Remarks |
|-------------|---------------------------------------------|---------------------------------------|---------------------------------------------|-----------|----------------|
| GT30F122 | 300 V / 120 A* | 2.4 | 25 | TO-220SIS | 5th generation |
| GT30F123 | 300 V / 200 A | 2.1 | 25 | TO-220SIS | 6th generation |
| GT30F124 | 300 V / 200 A | 2.3 | 25 | TO-220SIS | 6th generation |
| GT30F125 | 330 V / 200 A | 1.9 | 25 | TO-220SIS | 6th generation |
| GT45F122 | 300 V / 200 A | 2.2 | 25 | TO-220SIS | 5th generation |
| GT45F123 | 300 V / 200 A | 1.95 | 26 | TO-220SIS | 5th generation |
| GT45F124 | 300 V / 200 A | 1.7 | 29 | TO-220SIS | 5th generation |
| GT45F125 | 300 V / 200 A | 1.45 | 29 | TO-220SIS | 5th generation |
| GT45F127 | 300 V / 200 A | 1.6 | 26 | TO-220SIS | 6th generation |
| GT45F128 | 330 V / 200 A | 1.45 | 26 | TO-220SIS | 6th generation |
| GT45F131 | 300 V / 200 A | 1.7 | 160 | TO-220SM | 5th generation |

*: @ 100 μs

■ : New product

400-V IGBTs

| Part Number | V _{CE(S)} / I _{CP} @ 3 μs | V _{CE(sat)} (V) Typ. @ 120 A | P _C (W) @ T _C = 25 °C | Package | Remarks |
|-------------|---------------------------------------------|---------------------------------------|---------------------------------------------|-----------|----------------|
| GT30G122 | 400 V / 120 A* | 2.6 | 25 | TO-220SIS | 5th generation |
| GT30G123 | 430 V / 200 A | 2.2 | 25 | TO-220SIS | 6th generation |
| GT30G124 | 430 V / 200 A | 2.5 | 25 | TO-220SIS | 6th generation |
| GT30G125 | 430 V / 200 A | 2.1 | 25 | TO-220SIS | 6th generation |
| GT45G122 | 400 V / 200 A | 2.4 | 25 | TO-220SIS | 5th generation |
| GT45G123 | 400 V / 200 A | 2.1 | 26 | TO-220SIS | 5th generation |
| GT45G124 | 400 V / 200 A | 1.9 | 29 | TO-220SIS | 5th generation |
| GT45G125 | 400 V / 200 A | 1.6 | 29 | TO-220SIS | 5th generation |
| GT45G127 | 430 V / 200 A | 1.7 | 26 | TO-220SIS | 6th generation |
| GT45G128 | 430 V / 200 A | 1.55 | 26 | TO-220SIS | 6th generation |
| GT45G131 | 400 V / 200 A | 1.9 | 160 | TO-220SM | 5th generation |

*: @ 100 μs

■ : New product

600-V IGBTs

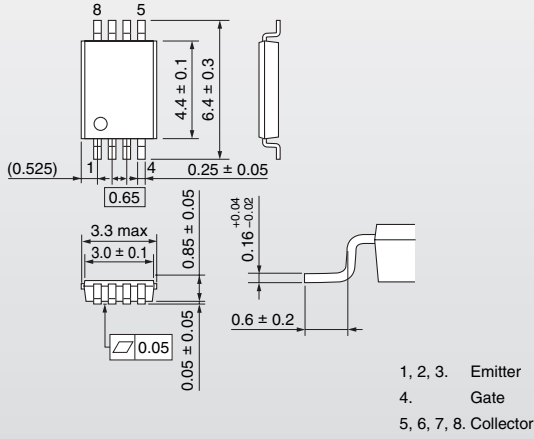
| Part Number | V _{CE(S)} / I _{CP} @ 3 μs | V _{CE(sat)} (V) Typ. @ 120 A | P _C (W) @ T _a = 25 °C | Package | Remarks |
|-------------|---------------------------------------------|---------------------------------------|---------------------------------------------|-----------|----------------|
| GT30J124 | 600 V / 200 A | 2.4 | 26 | TO-220SIS | 5th generation |

■ : New product

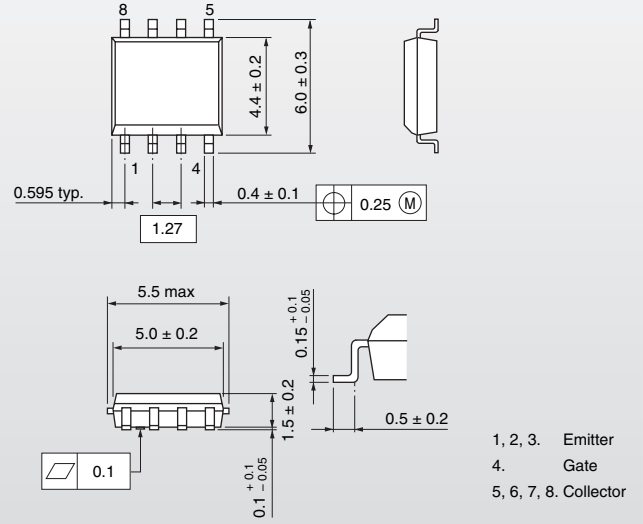
6 Package Dimensions

Unit: mm

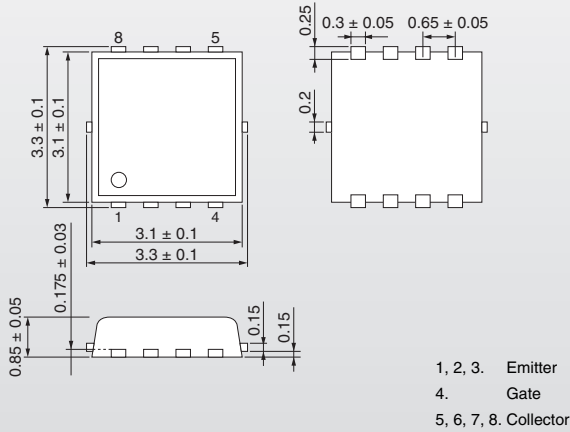
TSSOP-8



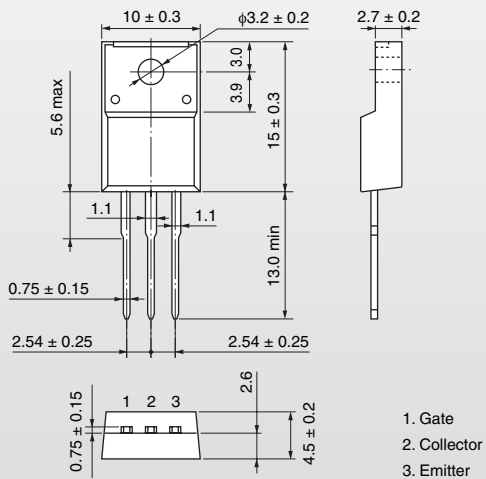
SOP-8



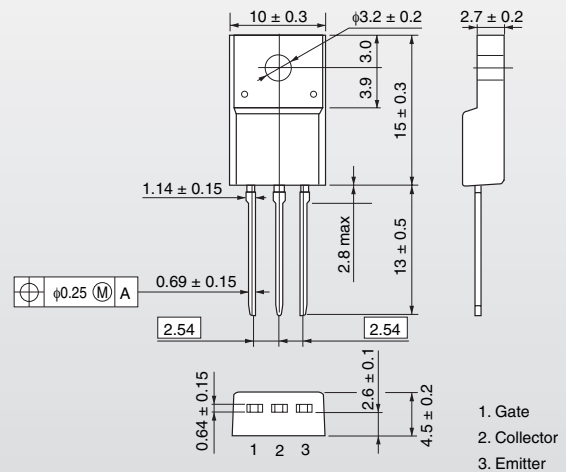
TSOP-8



TO-220NIS



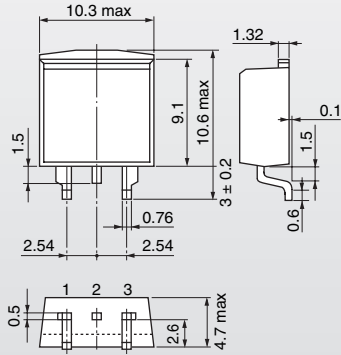
TO-220SIS



6 Package Dimensions

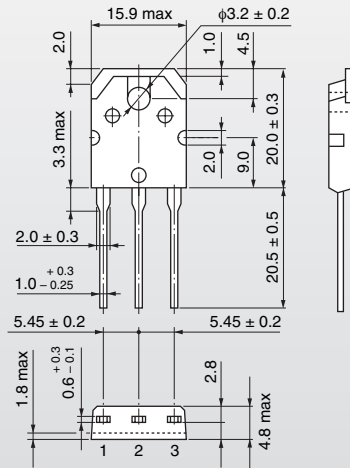
Unit: mm

▶ TO-220SM



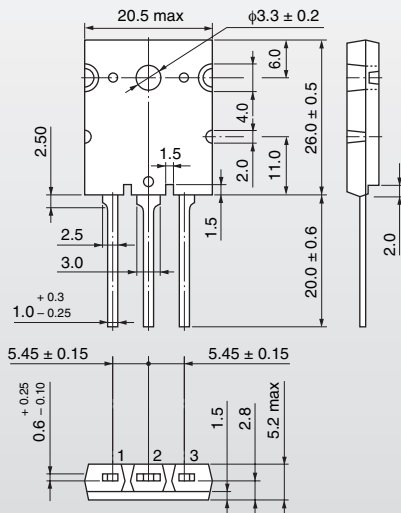
1. Gate
2. Collector
3. Emitter

▶ TO-3P(N)



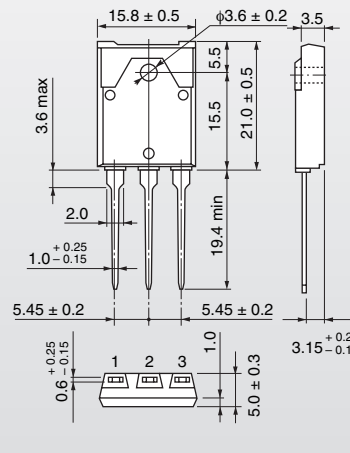
1. Gate
2. Collector
3. Emitter

▶ TO-3P(LH)



1. Gate
2. Collector
3. Emitter

▶ TO-3P(N)IS



1. Gate
2. Collector
3. Emitter

7 Final-Phase and Obsolete Products

The following products are in stock but are being phased out of production. The recommended replacements that continue to be available are listed in the right-hand column. However, the characteristics of the recommended replacements may not be exactly the same as those of the final-phase and obsolete products. Before using a recommended replacement, be sure to check that it is suitable for use under the intended operating conditions.

| Application | Final-Phase or Obsolete Product | Absolute Maximum Ratings | | Package | Recommended Obsolete Replacements | Absolute Maximum Ratings | | Package |
|-----------------------------------------------------------|---------------------------------|--------------------------|-----------------------|--------------|-----------------------------------|--------------------------|-----------------------|-----------|
| | | V _{CE} (V) | I _c (A) DC | | | V _{CE} (V) | I _c (A) DC | |
| Soft switching Resonant switching | MG30T1AL1 | 1500 | 30 | IH | – | – | – | – |
| | MG60M1AL1 | 900 | 60 | IH | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT40M101 | 900 | 40 | TO-3P(N)IS | – | – | – | – |
| | GT40M301 | 900 | 40 | TO-3P(LH) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT40Q322 | 1200 | 39 | TO-3P(N) | GT40Q321 | 1200 | 42 | TO-3P(N) |
| | GT40Q323 | 1200 | 39 | TO-3P(N) | GT40Q321 | 1200 | 42 | TO-3P(N) |
| | GT40T101 | 1500 | 40 | TO-3P(LH) | – | – | – | – |
| | GT40T301 | 1500 | 40 | TO-3P(LH) | GT40T302 | 1500 | 40 | TO-3P(LH) |
| | GT50L101 | 800 | 50 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT50M101 | 900 | 50 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT50Q101 | 1200 | 50 | IH | – | – | – | – |
| | GT50S101 | 1400 | 50 | IH | – | – | – | – |
| | GT50T101 | 1500 | 50 | IH | – | – | – | – |
| | GT60J101 | 600 | 60 | TO-3P(L) | GT80J101B | 600 | 60 | TO-3P(LH) |
| | GT60J322 | 600 | 60 | TO-3P(LH) | GT60J321 | 600 | 60 | TO-3P(LH) |
| | GT60M101 | 900 | 60 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M102 | 900 | 60 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M103 | 900 | 60 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M104 | 900 | 60 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M105 | 900 | 60 | TO-3P(L) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M301 | 900 | 60 | TO-3P(LH) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M302 | 900 | 60 | TO-3P(LH) | GT60M303 | 900 | 60 | TO-3P(LH) |
| | GT60M305 | 900 | 60 | TO-3P(LH) | GT60M303 | 900 | 60 | TO-3P(LH) |
| GT60M322 | 950 | 60 | TO-3P(LH) | GT60N321 | 1000 | 60 | TO-3P(LH) | |
| GT60N323 | 1050 | 60 | TO-3P(LH) | GT60N322 | 1000 | 57 | TO-3P(LH) | |
| GT80J101 | 600 | 80 | TO-3P(L) | GT80J101B | 600 | 80 | TO-3P(LH) | |
| GT80J101A | 600 | 80 | TO-3P(LH) | GT80J101B | 600 | 80 | TO-3P(LH) | |
| General-purpose motors General-purpose inverters | GT8J101 | 600 | 8 | TO-220NIS | GT10J303 | 600 | 10 | TO-220NIS |
| | GT8J102 | 600 | 8 | TO-220SM | GT10J312 | 600 | 10 | TO-220SM |
| | GT8N101 | 1000 | 8 | TO-3P(N) | GT10Q101 | 1200 | 10 | TO-3P(N) |
| | GT8Q101 | 1200 | 8 | TO-3P(N) | GT10Q101 | 1200 | 10 | TO-3P(N) |
| | GT8Q102 | 1200 | 8 | TO-220SM | – | – | – | – |
| | GT10Q311 | 1200 | 10 | TO-3P(SM) | – | – | – | – |
| | GT15J101 | 600 | 15 | TO-3P(N) | GT20J101 | 600 | 20 | TO-3P(N) |
| | GT15J102 | 600 | 15 | TO-220NIS | GT15J301 | 600 | 15 | TO-220NIS |
| | GT15J103 | 600 | 15 | TO-220SM | GT15J311 | 600 | 15 | TO-220SM |
| | GT15N101 | 1000 | 15 | TO-3P(N) | GT15Q102 | 1200 | 15 | TO-3P(N) |
| | GT15Q101 | 1200 | 15 | TO-3P(N) | GT15Q102 | 1200 | 15 | TO-3P(N) |
| | GT15Q311 | 1200 | 15 | TO-3P(SM) | – | – | – | – |
| | GT20J311 | 600 | 20 | TO-3P(SM) | – | – | – | – |
| | GT25H101 | 500 | 25 | TO-3P(N) | GT30J121 | 600 | 30 | TO-3P(N) |
| | GT25J101 | 600 | 25 | TO-3P(N) | GT30J121 | 600 | 30 | TO-3P(N) |
| | GT25J102 | 600 | 25 | TO-3P(N)IS | GT30J126 | 600 | 30 | TO-3P(N) |
| | GT25Q101 | 1200 | 25 | TO-3P(LH) | GT25Q102 | 1200 | 25 | TO-3P(LH) |
| | GT30J311 | 600 | 30 | TO-3P(SM) | – | – | – | – |
| | GT50J101 | 600 | 50 | TO-3P(L) | GT50J121 | 600 | 50 | TO-3P(LH) |
| | Strobe flashes | GT5G101 | 400 | 130 (pulsed) | NPM | – | – | – |
| GT5G102 | | 400 | 130 (pulsed) | DP | – | – | – | – |
| GT5G103 | | 400 | 130 (pulsed) | DP | – | – | – | – |
| GT8G101 | | 400 | 130 (pulsed) | NPM | – | – | – | – |
| GT8G102 | | 400 | 150 (pulsed) | NPM | – | – | – | – |
| GT8G103 | | 400 | 150 (pulsed) | DP | – | – | – | – |
| GT8G121 | | 400 | 150 (pulsed) | DP | – | – | – | – |
| GT10G101 | | 400 | 130 (pulsed) | TO-220NIS | – | – | – | – |
| GT10G102 | | 400 | 130 (pulsed) | TO-220NIS | – | – | – | – |
| GT15G101 | | 400 | 170 (pulsed) | TO-220NIS | – | – | – | – |
| GT20G101 | | 400 | 130 (pulsed) | TO-220FL | – | – | – | – |
| GT20G102 | | 400 | 130 (pulsed) | TO-220FL | – | – | – | – |
| GT25G101 | | 400 | 170 (pulsed) | TO-220FL | – | – | – | – |
| GT25G102 | | 400 | 150 (pulsed) | TO-220FL | – | – | – | – |
| GT50G101 | | 400 | 100 (pulsed) | TO-3P(N) | – | – | – | – |
| GT50G102 | | 400 | 100 (pulsed) | TO-3P(N) | – | – | – | – |
| Audio amps | GT75G101 | 400 | 150 (pulsed) | TO-3P(N) | – | – | – | – |
| | GT20D101 | 250 | 20 | TO-3P(L) | – | – | – | – |
| | GT20D201 | –250 | –20 | TO-3P(L) | – | – | – | – |

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