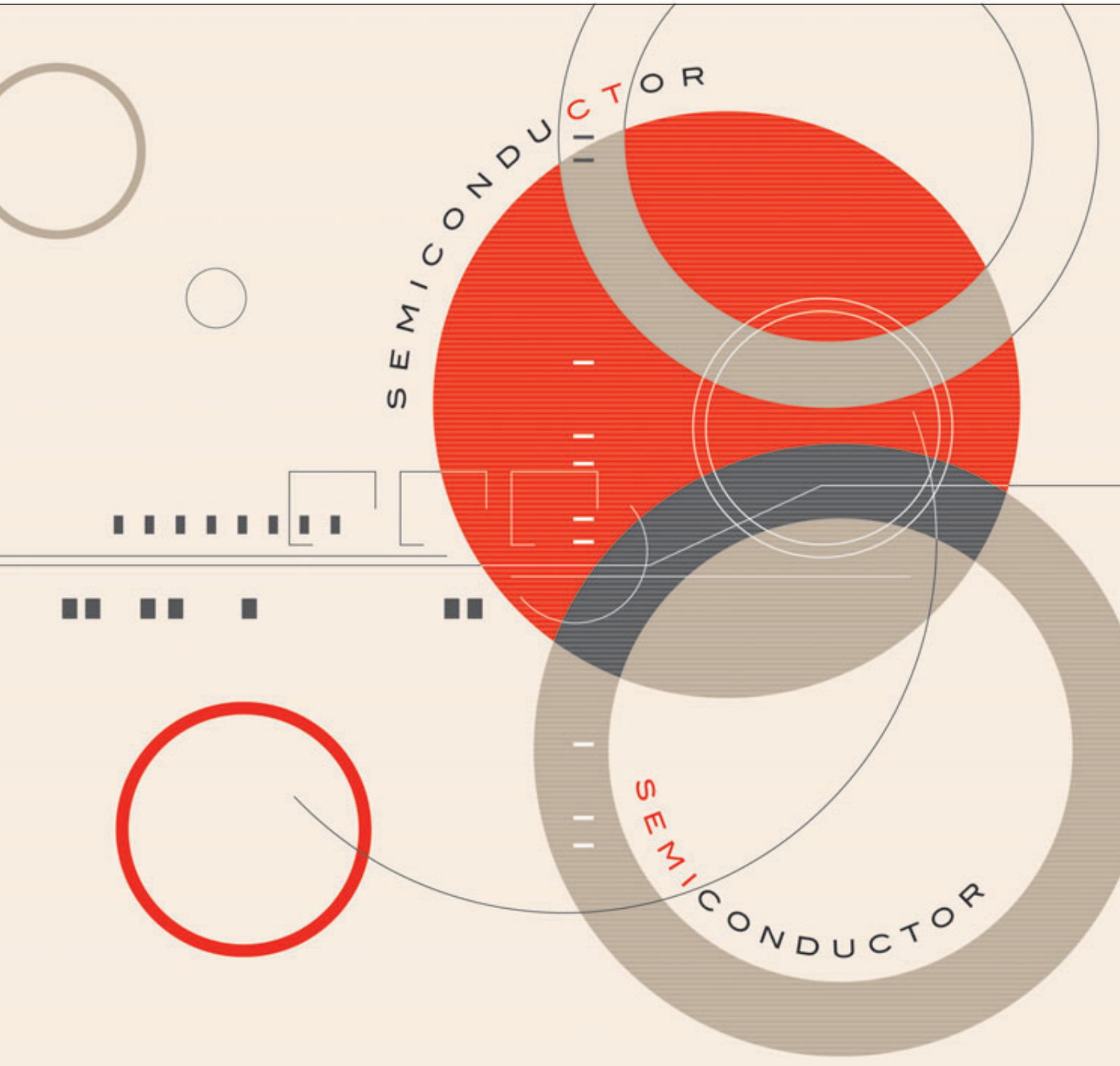
TOSHIBA
Leading Innovation

2011-3

PRODUCT GUIDE

Discrete IGBTs



• SEMICONDUCTOR •

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

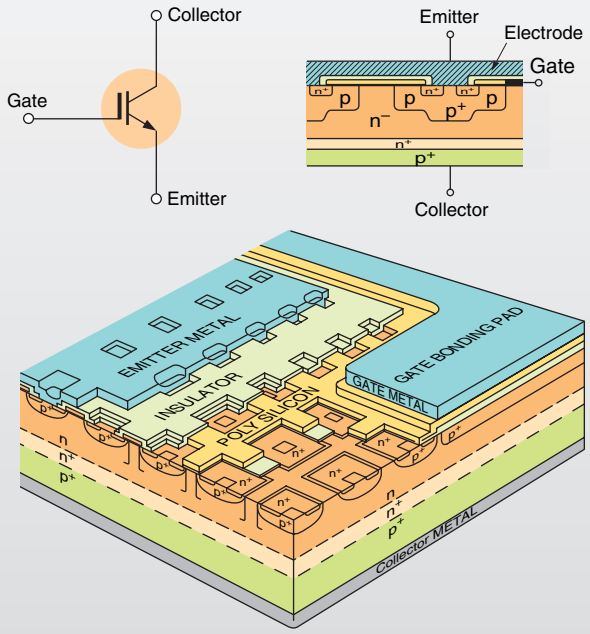
The Toshiba discrete IGBTs are available in high-voltage and high-current ratings. They are used in inverter and power conversion circuits for such diverse applications as motor drivers, uninterruptible power supply (UPS) systems, IH cookers, plasma display panels (PDPs), strobe flashes and so on.

(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

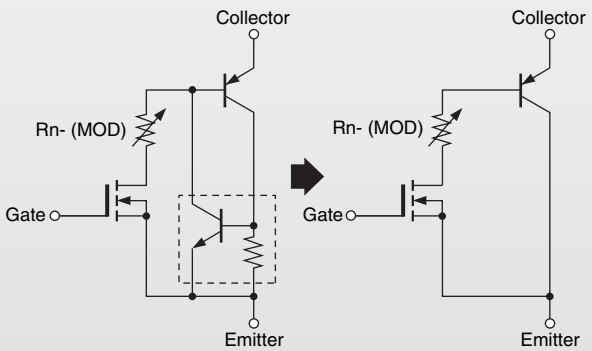
Construction

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.

Planar Structure



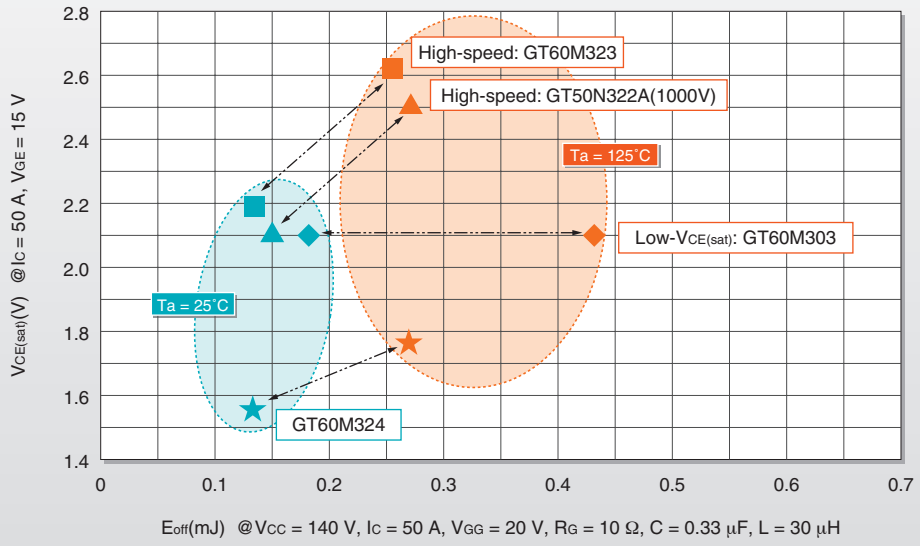
Equivalent Circuit



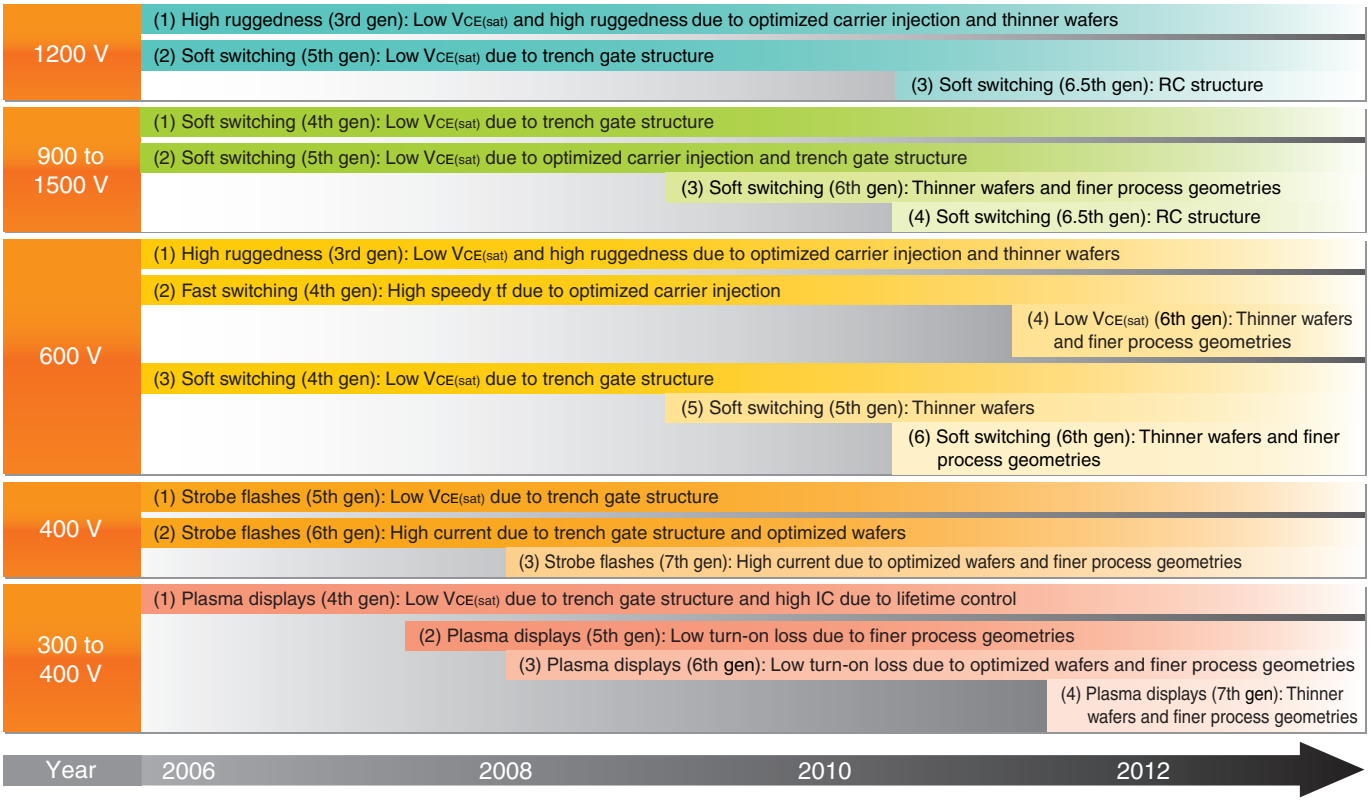
2 IGBT Technical Overview

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



3 Discrete IGBT Product Lineup

Applications and Features	Breakdown Voltage V_{CES} (V) @Ta = 25°C	IGBT Current Rating I_C (A) @Ta = 25°C		TSON-8	SOP-8	TO-220SIS	TO-220SM(MXN)	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	10	20					GT10J301		
		20	40					GT20J301 GT20J101		
		30	60					GT30J301 GT30J101		
		50	100							GT50J102
	1200	10	20					GT10Q301 GT10Q101		
		15	30					GT15Q301 GT15Q102		
		25	50							GT25Q301 GT25Q102
General-purpose inverters Fast switching Hard switching fc: up to 50 kHz FS series	600	30	60					GT30J324 GT30J121	GT30J126	
		50	100							GT50J325 GT50J121
Resonant switching Soft switching Soft-Switching Series	600	30	100						GT30J322	
		37	100						GT35J321	
		40	100					GT40J321 GT40J322 GT40J323	GT40J325	
		50	100					GT50J327 GT50J341		GT50J322 GT50J322H
			120					GT50J328		
		60	120							GT60J321 GT60J323 GT60J323H
	900	15	30						GT15M321	
		35	100						GT35MR21	
		50	100					GT50MR21		
			120					GT50M322		
		60	120					GT60M324		
	1000	50	120					GT50N322A GT50N324		
		60	120							GT60N321
	1050	50	100					GT50NR21		
	1200	40	80					GT40QR21		
	1500	40	80					GT40T321		
PFC	600	30	100					GT30J122A	GT30J122	
		40	100						GT40J121	
Strobe flashes	400		130	GT5G133						
			150	GT8G151	GT8G132					
			200		GT10G131					
Plasma display panels	300		200			GT30F124 GT45F127				
	330		200			GT30F125 GT45F128				
	360		200				GT30F131			
	430		200			GT30G124 GT30G125 GT45G127 GT45G128				
	600		200			GT30J124				

: New product

4 Part Numbering Scheme

Example **GT 60 M 3 03 A**

- A: Version
- 03: Serial number
- 3: 1: N-channel
2: P-channel
3: N-channel with built-in freewheeling diode
R: N-channel RC-IGBT with built-in freewheeling diode
- M: Voltage rating (see Table 1.)
- 60: Collector current rating (DC)
- GT: Discrete IGBT

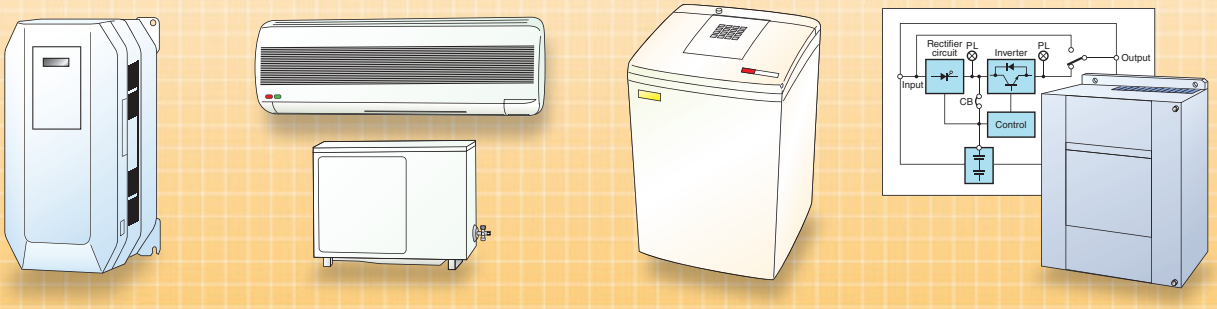
Table 1

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



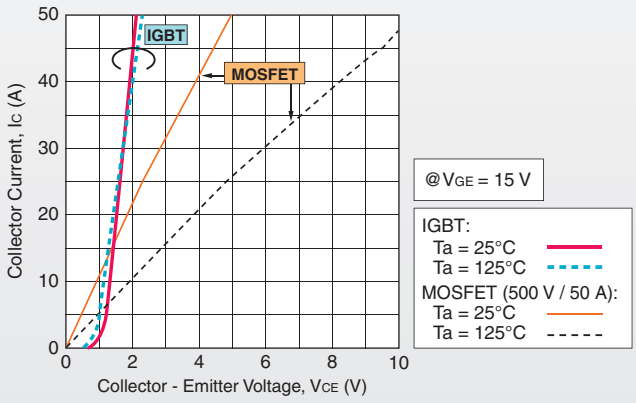
Discrete IGBT Trend

▶ 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

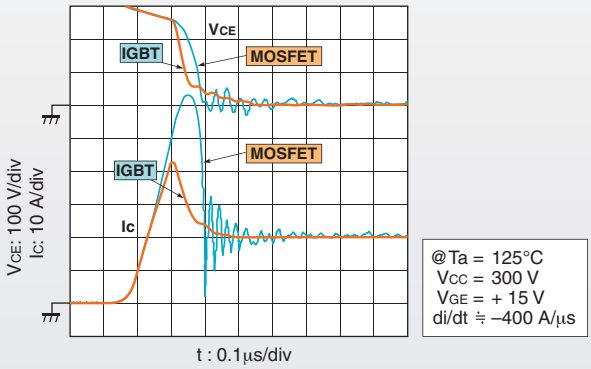
▶ IC - VCE Temperature Characteristics

Low saturation voltage with minimal temperature dependence



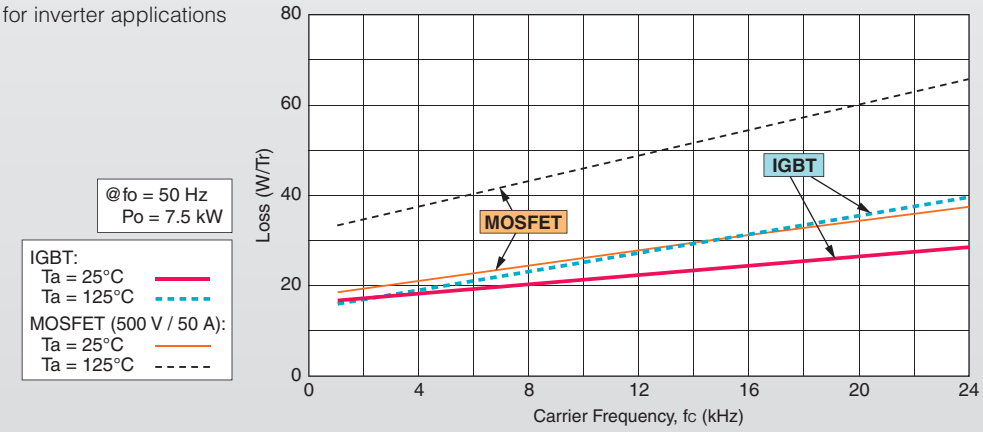
▶ Turn-On Waveform

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



▶ Power Loss vs. Carrier Frequency Characteristics

Simulation data for inverter applications

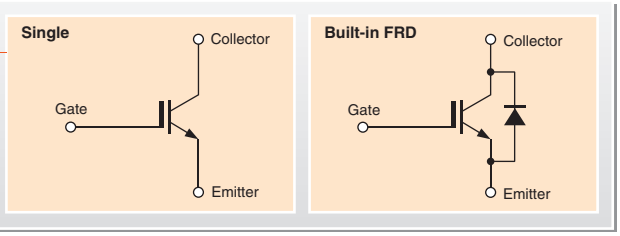


5-1 General-Purpose Inverter

Product Lineup

▶ For general-purpose inverters

▶ Circuit Configurations



600-V and 1200-V IGBTs

Main Applications	Features	Part Number	Absolute Maximum Ratings				Package	Circuit Configuration (*1)	$V_{CE(sat)}$ Typ.			t_f Typ.		Remarks
			V_{CES} (V)	I_C DC (A)	I_C Pulsed (A)	P_C T_c = 25°C (W)			(V)	@I_C (A)	@V_{GE} (V)	(μs)	Load (*2)	
Motor driving (UPS/PFC)	High V_{CES} (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 V_{CES} (600V)	**GT10J301**	600	10	20	90	TO-3P(N)	Built-in FRD	2.1	10	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	

600-V Fast IGBTs (4th Generation)

(FS: Fast Switching)

Main Applications	Features	Part Number	Absolute Maximum Ratings				Package	Circuit Configuration (*1)	$V_{CE(sat)}$ Typ.			t_f Typ.		Remarks
			V_{CES} (V)	I_C DC (A)	I_C Pulsed (A)	P_C T_c = 25°C (W)			(V)	@I_C (A)	@V_{GE} (V)	(μs)	Load (*2)	
Inverter power supplies (UPS/PFC/motor)	Fast switching	**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	

600-V IGBTs for Low Frequency Switching

Main Applications	Features	Part Number	Absolute Maximum Ratings				Package	Circuit Configuration (*1)	$V_{CE(sat)}$ Typ.			t_f Typ.		Remarks
			V_{CES} (V)	I_C DC (A)	I_C Pulsed (A)	P_C T_c = 25°C (W)			(V)	@I_C (A)	@V_{GE} (V)	(μs)	Load (*2)	
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
		GT30J122A	600	30	100	120	TO-3P(N)	◆	1.7	50	15	0.2	R	Partial Switching Converter
		GT40J121	600	40	100	80	TO-3P(N)IS	◆	1.45	40	15	0.2	R	Partial Switching Converter

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

: New product

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

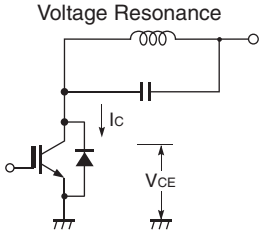
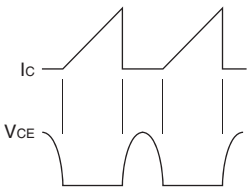
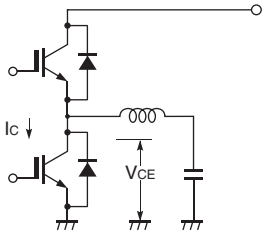
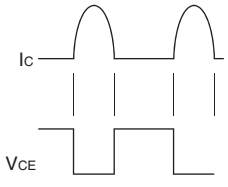


IH Cookers



MFPs



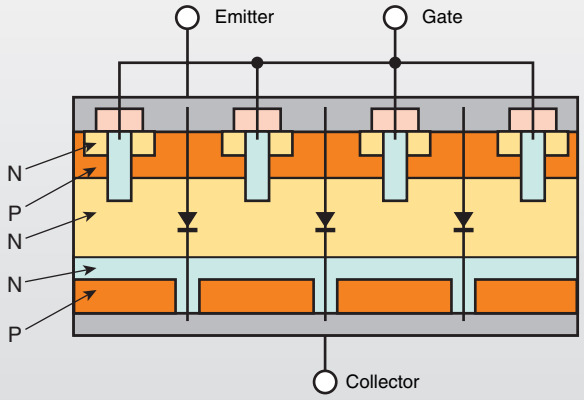
AC Input Voltage	Circuit	IGBT Rating
100 V to 120 V	Voltage Resonance  Waveform  	VCES = 900 V to 1050 V IC = 15 A to 60 A
200 V to 240 V		VCES = 1200 V to 1500 V IC = 40 A
100 V to 240 V	Current Resonance  Waveform  	VCES = 600 V IC = 30 A to 60 A

IH: Induction heating
MFP: Multifunction Printer

6.5th-Generation RC-IGBT Series (New Products)

The RC-IGBT (Reverse-Conducting IGBT) Series consists of a freewheeling diode monolithically integrated in an IGBT chip. This is realized by forming an N layer through the P layer on the collector side. The RC-IGBT Series is environmentally friendly since it eliminates the need for a separate diode. Additionally, it also features a reduced thermal resistance of the freewheeling diode.

Cross-Sectional View of the RC-IGBT



Product Lineup

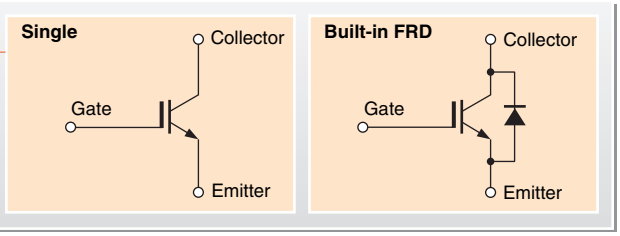
▶ For soft switching

Main Applications		Features	Part Number	Absolute Maximum Ratings					Package	Circuit Configuration (*1)	$V_{CE(sat)}$ Typ. @Ta = 25˚C			t_f Typ. @Ta = 25˚C		Remarks
				V_{CES} (V)	I_C		P_C				(V)	I_C (A)	V_{GE} (V)	(μs)	Load (*2)	
					DC (A)	Pulsed (A)	T_C = 25˚C (W)	Tj (˚C)								
IH rice cookers and IH cooktops	AC 100 V	Voltage resonance	**GT35MR21**	900	35	100	82	150	TO-3P(N)IS	Built-in FWD	1.6	35	15	0.2	R	6.5th generation
			GT50MR21	900	50	100	230	175	TO-3P(N)	Built-in FWD	1.7	50	15	0.18	R	6.5th generation Tj = 175˚C
			GT50NR21	1050	50	100	230	175	TO-3P(N)	Built-in FWD	1.8	50	15	0.2	R	6.5th generation Tj = 175˚C
	AC 200 V		**GT40QR21**	1200	40	80	230	175	TO-3P(N)	Built-in FWD	1.9	40	15	0.2	R	6.5th generation Tj = 175˚C

*1 Abbreviation in the “Circuit Configuration” column
FWD: Free-Wheeling Diode
*2 Abbreviation in the “Load” column
R : Resistive load

: New product

▶ Circuit Configurations



IGBTs for Soft-Switching Applications

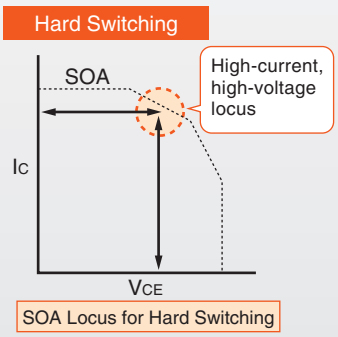
Main Applications		Features	Part Number	Absolute Maximum Ratings					Package	Circuit Configuration (*1)	$V_{CE(sat)}$ Typ.			t_f Typ.		Remarks
				V_{CES} (V)	I_C DC (A)	I_C Pulsed (A)	P_C T_C = 25˚C (W)	Tj (˚C)			(V)	@I_C (A)	@V_{GE} (V)	(μs)	Load (*2)	
IH rice cookers and IH cooktops	AC 200 V	Current resonance	**GT30J322**	600	30	100	75	150	TO-3P(N)IS	Built-in FRD	2.1	50	15	0.25	R	
			GT35J321	600	37	100	75	150	TO-3P(N)IS	Built-in FRD	1.9	50	15	0.19	R	
			GT40J321	600	40	100	120	150	TO-3P(N)	Built-in FRD	2.0	40	15	0.11	R	Fast switching
			GT40J322	600	40	100	120	150	TO-3P(N)	Built-in FRD	1.7	40	15	0.2	R	
			GT40J323	600	40	100	170	150	TO-3P(N)	Built-in FRD	2.0	40	15	0.06	R	Fast switching
			GT40J325	600	40	100	80	150	TO-3P(N)IS	Built-in FRD	1.45	40	15	0.2	R	6th generation
			GT50J322	600	50	100	130	150	TO-3P(LH)	Built-in FRD	2.1	50	15	0.25	R	
			GT50J322H	600	50	100	130	150	TO-3P(LH)	Built-in FRD	2.2	50	15	0.11	R	Fast switching
			GT50J327	600	50	100	140	150	TO-3P(N)	Built-in FRD	1.9	50	15	0.19	R	
			GT50J341	600	50	100	200	175	TO-3P(N)	Built-in FRD	1.6	50	15	0.15	R	6th generation Tj = 175˚C
			GT50J328	600	50	120	140	150	TO-3P(N)	Built-in FRD	2.0	50	15	0.10	R	Fast switching
			GT60J321	600	60	120	200	150	TO-3P(LH)	Built-in FRD	1.55	60	15	0.30	R	
			GT60J323	600	60	120	170	150	TO-3P(LH)	Built-in FRD	1.9	60	15	0.16	R	
			GT60J323H	600	60	120	170	150	TO-3P(LH)	Built-in FRD	2.1	60	15	0.12	R	Fast switching
	AC 100 V	Voltage resonance	**GT15M321**	900	15	30	55	150	TO-3P(N)IS	Built-in FWD	1.8	15	15	0.20	R	
			GT50M322	900	50	120	156	150	TO-3P(N)	Built-in FWD	2.1	60	15	0.25	R	
			GT60M324	900	60	120	254	175	TO-3P(N)	Built-in FWD	1.7	60	15	0.11	R	Tj = 175˚C
			GT50N322A	1000	50	120	156	150	TO-3P(N)	Built-in FWD	2.2	60	15	0.10	R	Fast switching
			GT50N324	1000	50	120	150	150	TO-3P(N)	Built-in FWD	1.9	60	15	0.11	R	6th generation
			GT60N321	1000	60	120	170	150	TO-3P(LH)	Built-in FWD	2.3	60	15	0.25	R	
	AC 200 V		**GT40T321**	1500	40	80	230	175	TO-3P(N)	Built-in FWD	2.15	40	15	0.24	R	Tj = 175˚C

*1 Abbreviations in the “Circuit Configuration” column
FRD: Fast Recovery Diode, FWD: Free-Wheeling Diode
*2 Abbreviation in the “Load” column
R : Resistive load

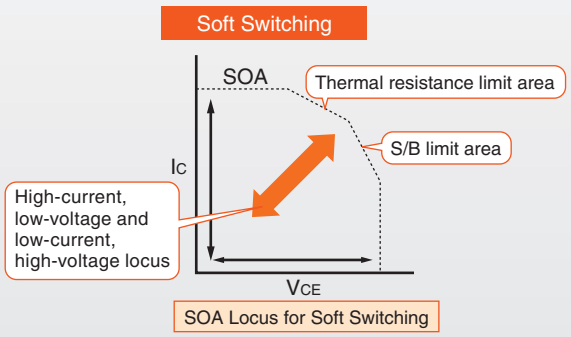
: New product

5-2 Soft-Switching Applications

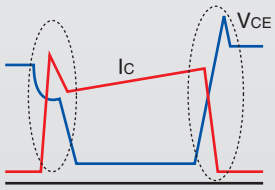
Comparisons Between Hard and Soft Switching (diagrams shown only as a guide)



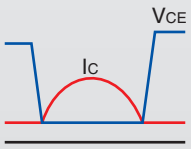
SOA Locus for Hard Switching



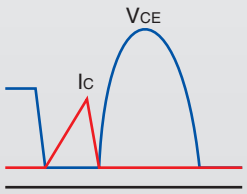
SOA Locus for Soft Switching



Switching Characteristics (Example)



Current Resonance (Example)



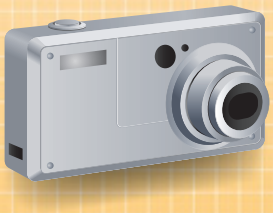
Voltage Resonance (Example)

5-3 Strobe Flash Applications

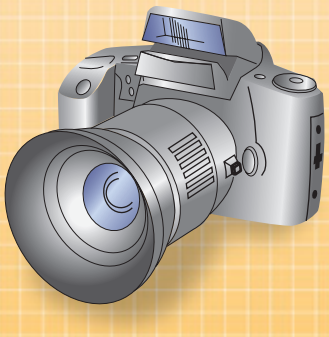
Strobe flash control is now prevalent in digital still cameras. Package sizes are getting smaller, and logic levels are increasingly used to represent the gate drive voltage. Toshiba offers compact IGBTs featuring low gate drive voltage.

- 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

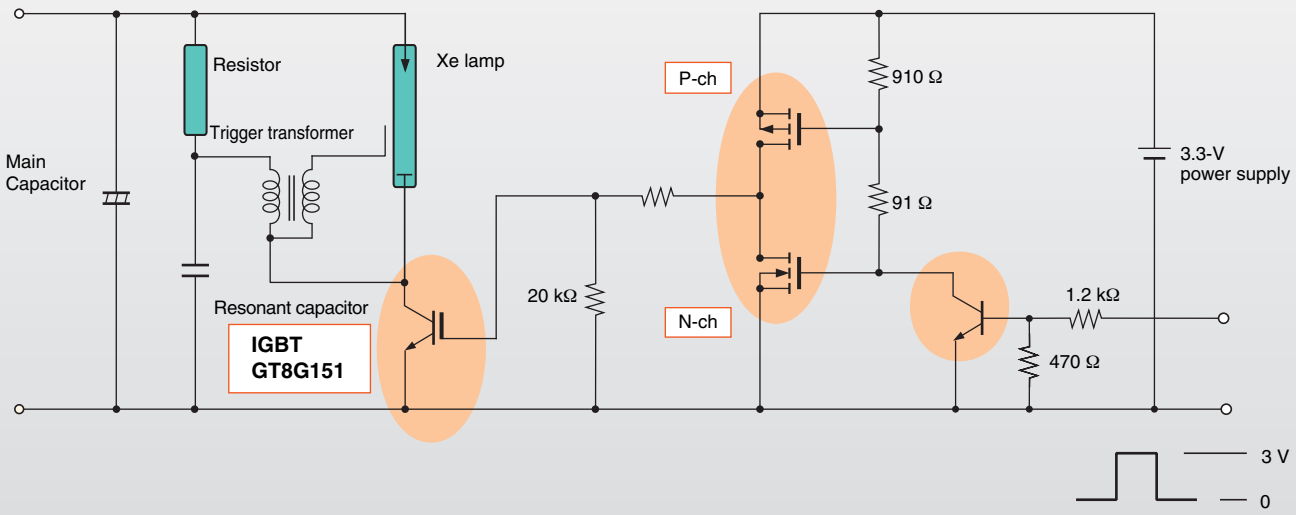
Product Lineup

▶ 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_{CES} / I_C	Gate Drive Voltage Min (V)	$V_{CE(sat)}$ (V) Typ.	$V_{CE(sat)}$ (V) V_{GE} / I_C	P_C (W) @Ta = 25˚C	Package	Remarks
GT5G133	400 V / 130 A	2.5	3.0	2.5 V / 130 A	0.83	**TSON-8**	7th generation
GT8G151	400 V / 150 A	2.5	2.65	2.5 V / 150 A	0.83	**TSON-8**	7th generation

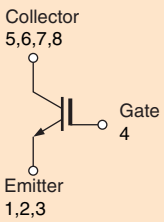
: New product

5-V Power Supply

Part Number	V_{CES} / I_C	Gate Drive Voltage Min (V)	$V_{CE(sat)}$ (V) Typ.	$V_{CE(sat)}$ (V) V_{GE} / I_C	P_C (W) @Ta = 25˚C	Package	Remarks
GT8G132	400 V / 150 A	4.0	2.3	4.0 V / 150 A	1.1	**SOP-8**	5th generation
GT10G131	400 V / 200 A	4.0	2.3	4.0 V / 200 A	1.9	**SOP-8**	5th generation

<Connection Examples>

Board connection example



All the emitter terminals should be connected together.

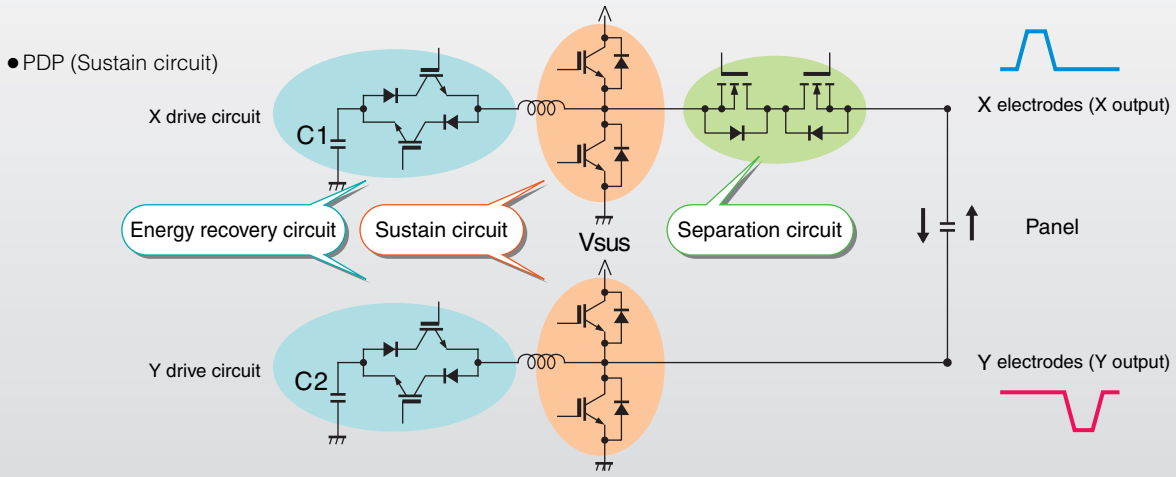
5-4 Plasma Display Panel Applications

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



Product Lineup

▶ For plasma display panels

300-V IGBTs

Part Number	V_{CES} / Icp @3 μs	$V_{CE(sat)}$ (V) Typ. @120 A	P_C (W) @Tc = 25°C	Package	Remarks
GT30F124	300 V / 200 A	2.3	25	**TO-220SIS**	6th generation
GT30F125	330 V / 200 A	1.9	25	**TO-220SIS**	6th 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
GT30F131	360 V / 200 A	1.9	140	**TO-220SM(MXN)**	6th generation

: New product

400-V IGBTs

Part Number	V_{CES} / Icp @3 μs	$V_{CE(sat)}$ (V) Typ. @120 A	P_C (W) @Tc = 25°C	Package	Remarks
GT30G124	430 V / 200 A	2.5	25	**TO-220SIS**	6th generation
GT30G125	430 V / 200 A	2.1	25	**TO-220SIS**	6th 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

: New product

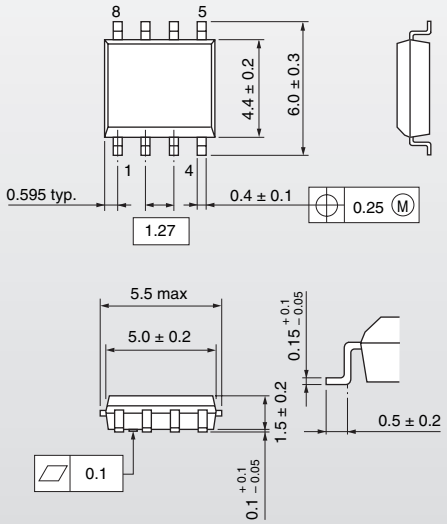
600-V IGBTs

Part Number	V_{CES} / Icp @3 μs	$V_{CE(sat)}$ (V) Typ. @120 A	P_C (W) @Tc = 25°C	Package	Remarks
GT30J124	600 V / 200 A	2.4	26	**TO-220SIS**	5th generation

6 Package Dimensions

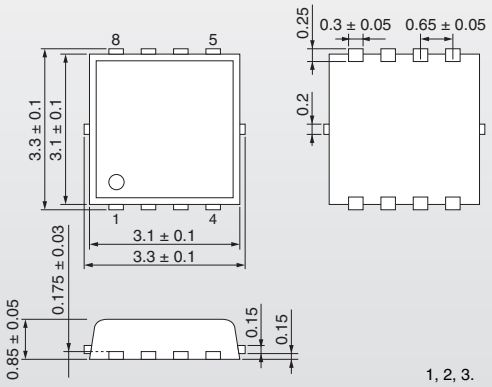
Unit: mm

SOP-8



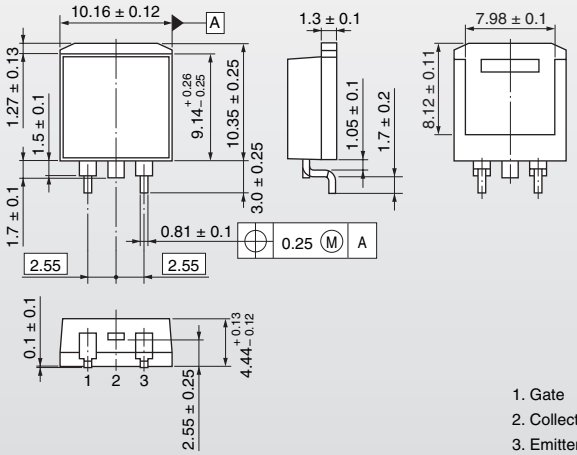
1, 2, 3. Emitter
4. Gate
5, 6, 7, 8. Collector

TSON-8



1, 2, 3. Emitter
4. Gate
5, 6, 7, 8. Collector

TO-220SM(MXN)

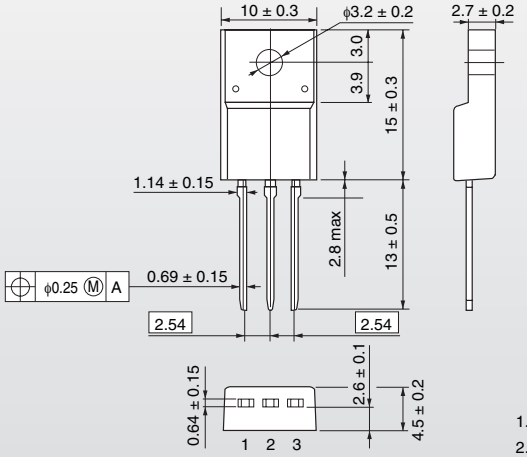


1. Gate
2. Collector
3. Emitter

6 Package Dimensions

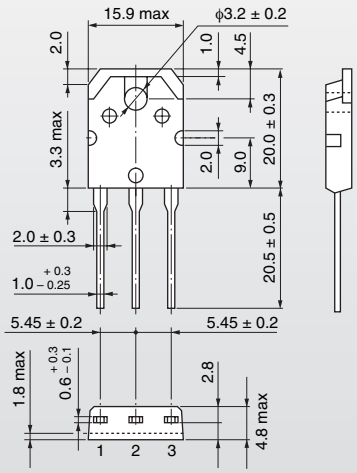
Unit: mm

TO-220SIS



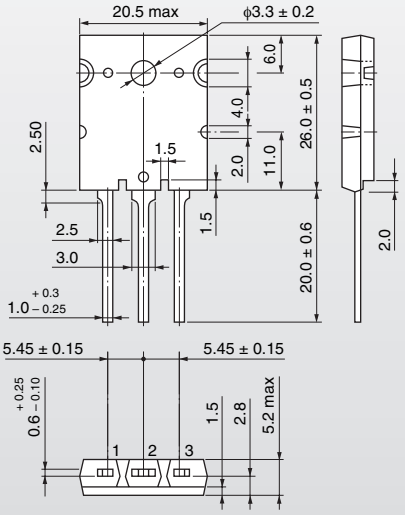
1. Gate
2. Collector
3. Emitter

TO-3P(N)



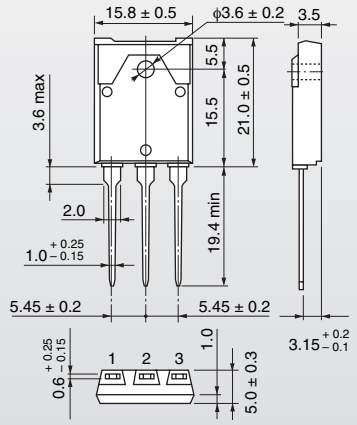
1. Gate
2. Collector
3. Emitter

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_{CES} (V)	I_C (A) DC			V_{CES} (V)	I_C (A) DC	
Soft switching Resonant switching	**MG30T1AL1**	1500	30	**IH**	–	–	–	–
	MG60M1AL1	900	60	**IH**	–	–	–	–
	GT40M101	900	40	**TO-3P(N)IS**	–	–	–	–
	GT40M301	900	40	**TO-3P(LH)**	–	–	–	–
	GT40Q322	1200	39	**TO-3P(N)**	–	–	–	–
	GT40Q323	1200	39	**TO-3P(N)**	–	–	–	–
	GT40T101	1500	40	**TO-3P(LH)**	–	–	–	–
	GT40T301	1500	40	**TO-3P(LH)**	–	–	–	–
	GT50L101	800	50	**TO-3P(L)**	–	–	–	–
	GT50M101	900	50	**TO-3P(L)**	–	–	–	–
	GT50Q101	1200	50	**IH**	–	–	–	–
	GT50S101	1400	50	**IH**	–	–	–	–
	GT50T101	1500	50	**IH**	–	–	–	–
	GT60J101	600	60	**TO-3P(L)**	–	–	–	–
	GT60J322	600	60	**TO-3P(LH)**	–	–	–	–
	GT60M101	900	60	**TO-3P(L)**	–	–	–	–
	GT60M102	900	60	**TO-3P(L)**	–	–	–	–
	GT60M103	900	60	**TO-3P(L)**	–	–	–	–
	GT60M104	900	60	**TO-3P(L)**	–	–	–	–
	GT60M105	900	60	**TO-3P(L)**	–	–	–	–
	GT60M301	900	60	**TO-3P(LH)**	–	–	–	–
	GT60M302	900	60	**TO-3P(LH)**	–	–	–	–
	GT60M305	900	60	**TO-3P(LH)**	–	–	–	–
	GT60M322	950	60	**TO-3P(LH)**	**GT60N321**	1000	60	**TO-3P(LH)**
	GT60N323	1050	60	**TO-3P(LH)**	–	–	–	–
	GT80J101	600	80	**TO-3P(L)**	–	–	–	–
	GT80J101A	600	80	**TO-3P(LH)**	–	–	–	–
General-purpose motors General-purpose inverters	**GT8J101**	600	8	**TO-220NIS**	–	–	–	–
	GT8J102	600	8	**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**	–	–	–	–
	GT15J103	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)IS**
	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)**	–	–	–	–
	GT75G101	400	150 (pulsed)	**TO-3P(N)**	–	–	–	–
Audio amps	**GT20D101**	250	20	**TO-3P(L)**	–	–	–	–
	GT20D201	–250	–20	**TO-3P(L)**	–	–	–	–

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