

Insulated Gate Bipolar Transistors (IGBTs)

Milestones in IGBT Technology

In 1986, Toshiba started the production of its 1st Generation 1000V IGBTs. With the introduction of Toshiba's 2nd Generation in 1989, IGBTs were made available in High Speed and Low Saturation types for both a 600V and a 1200V series. Since then IGBTs have made their way into many applications such as inverters, servo drives, Uninterruptible Power Supplies (UPS), induction ovens and arc welding. Toshiba is now recognized as the market leader in IGBT technology.

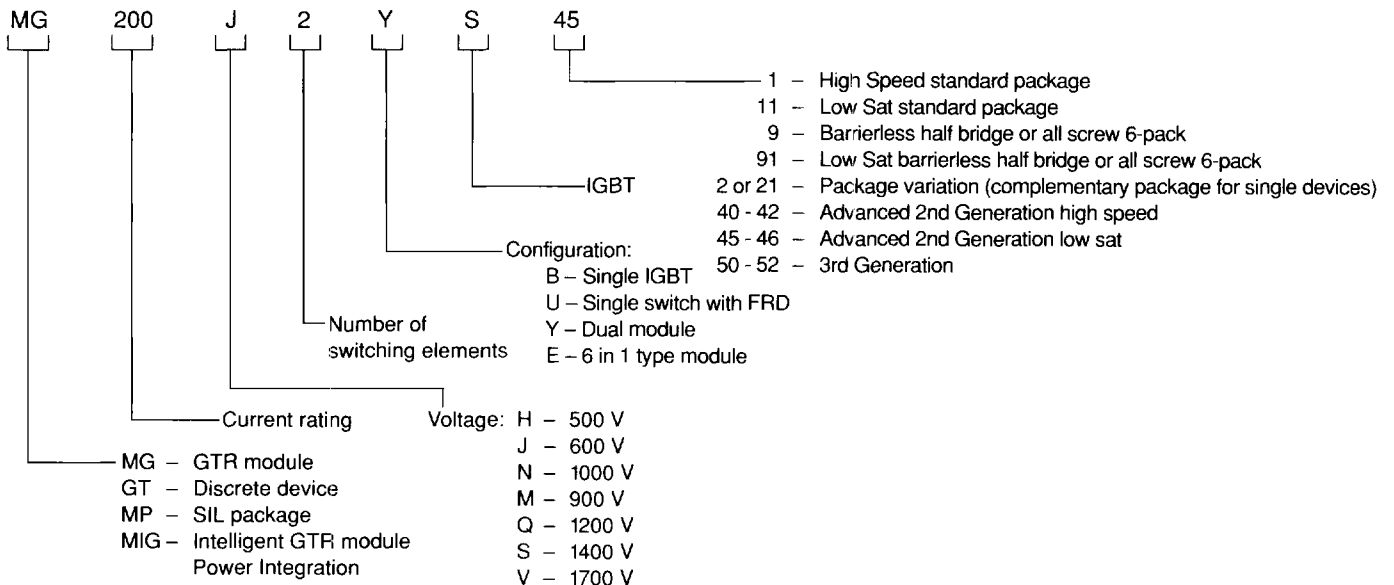
Today Toshiba is introducing the 600V 3rd Generation IGBT which uses a 1 μ m design rule. The new series combines low saturation and high speed in one device. In addition to the improvements in the IGBT chip, a new fast and soft recovery diode has been developed. With these improvements the total energy loss is 20% lower than the Advanced 2nd Generation devices. Another improvement in Toshiba's 3rd Generation IGBT is a square RBSOA at twice the rated current. A significant reduction of thermal impedance has been achieved by using a new AlN substrate.

Not only has Toshiba improved the IGBT, the FRD and the substrate, Toshiba has also improved the package layout. Two new low inductance packages are available with 50% lower internal inductance than conventional modules.

Beginning December, 1993 Toshiba will produce a full lineup of 1700V IGBT modules up to 360A. This series has been specially developed to meet the requirements of 575-600V AC lines as well as traction applications.

Power Integration (PI) devices combine all power elements of a 3-phase inverter (IGBTs, FRDs, rectifier and brake chopper) in one package. These devices are very small and eliminate component count to reduce system size of small drives. PIs have been available in 600V and 1200V since early 1993.

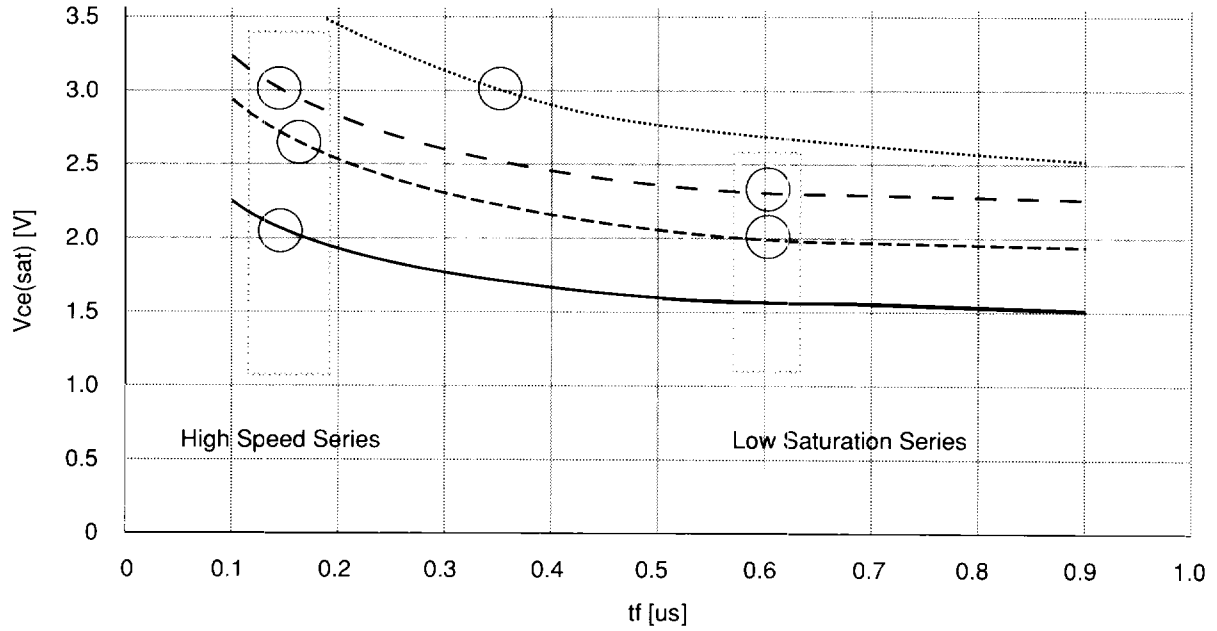
IGBT Part Numbers



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Trade-Off Improvements

600V IGBT



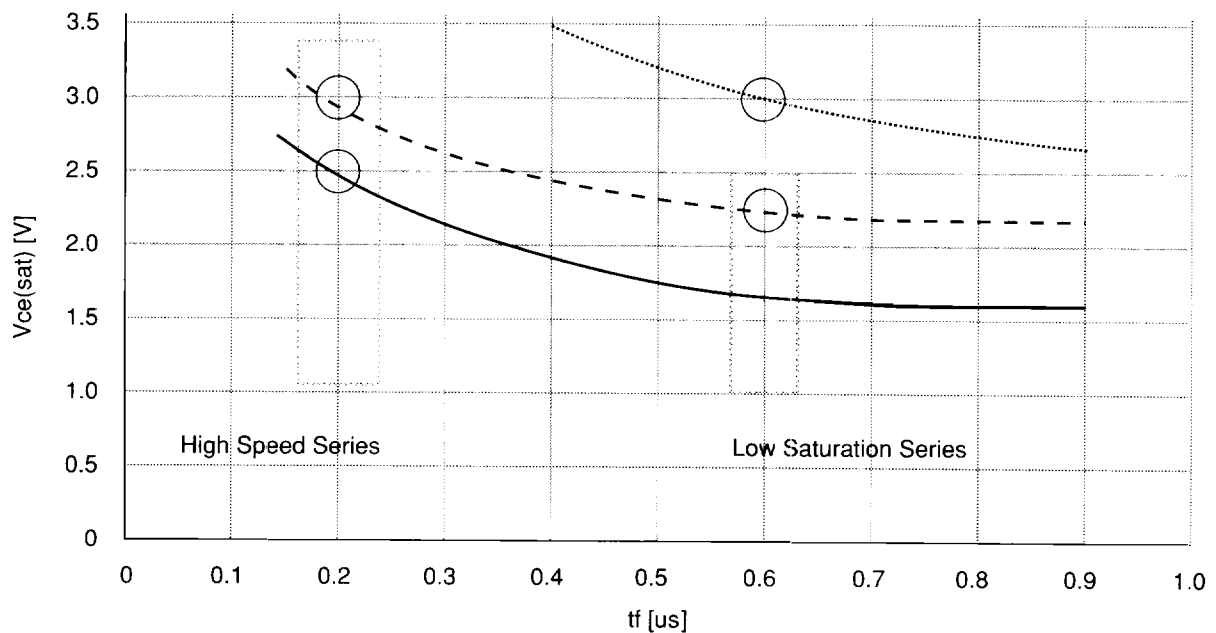
1st Generation 1985

2nd Generation 1989

Advanced 2nd Generation 1991

3rd Generation 1993

1200V IGBT



1st Generation 1985

2nd Generation 1989

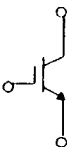
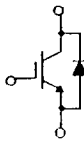
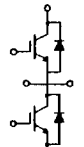
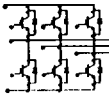
Advanced 2nd Generation 1991

4th Generation 1993

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High Speed Series

(For $f_c > 5 \text{ kHz}$)

Circuit	V _{CE}	Maximum Ratings									
		I _c (A)									
		8	15	25	50	60/200	80/300	400	500	600	800
 BS	600	GT8J101 TO-220(S) GT8J102(SM) TO-220(SM)	GT15J101 @ TO-3P(N) GT15J102 TO-220(S) GT15J103(SM) TO-220(SM) S5J14M TO-220(SM) 20A FRD	GT25J101 @ TO-3P(N)	GT50J101 @ TO-3P(L) S5978 2-33F1A 2 x 50 A FRD	GT60J101 @ TO-3P(L) (60 A) GT60M301 TO-3P(LH) (60A/900V)	GT80J101 @ TO-3P(L) (80 A)				
	1200	GT8Q101 @ TO-3P(N) GT8Q102(SM) TO-220(SM)	GT15Q101 @ TO-3P(N) S5J17M TO-220(SM) 15 A FRD	GT25Q101 @ TO-3P(L) MG25Q1BS1 2-33F1A	GT50Q101 @ IH MG50Q1BS1 2-33F1A S5979 2-33F1A 2 x 50 A FRD						
 US	600					MG300J1US1 2-109A4A MG300J1US51 2-109A4A	MG400J1US41 2-109A4A MG400J1US51 2-109A4A		MG600J1US51 2-109A4B	MG800J1US51 2-109A4B	
	1200					MG200Q1US1 2-109A4A MG200Q1US41 2-109A4A	MG300Q1US1 2-109A4A MG300Q1US41 2-109A4A	MG400Q1US1 2-109A4A MG400Q1US2 2-109A4B MG400Q1US41 2-109A4A MG400Q1US42 2-109A4B	MG500Q1US1 2-109A4A MG500Q1US2 2-109A4B	MG600Q1US41 2-109A4B	
	1700					MG240V1US41 (240 A) 2-109A4A		MG360V1US41 (360 A) 2-109A4B			
		8	15	25	50	75	100	150	200	300	400
 YS	600			MG25J2YS40 2-94D1A	MG50J2YS40 2-94D1A MG50J2YS50 2-94D1A	MG75J2YS40 2-94D1A MG75J2YS50 2-94D1A	MG100J2YS40 2-94D1A MG100J2YS50 2-94D1A	MG150J2YS40 2-95A1A MG150J2YS50 2-95A1A	MG200J2YS40 2-95A1A MG200J2YS50 2-95A1A	MG300J2YS40 2-109C1A MG300J2YS50 2-109C1A	MG400J2YS40 2-109D1A MG400J2YS50 2-109D1A
	1200			MG25Q2YS40 2-94D1A	MG50Q2YS40 2-94D1A	MG75Q2YS40 2-94D1A	MG100Q2YS1 2-108A2A MG100Q2YS9 2-109C1A	MG150Q2YS1 2-109B4A MG150Q2YS9 2-109C1A	MG200Q2YS1 2-109B4A MG200Q2YS9 2-109C1A		
	1700			MG30V2YS40 (30 A) 2-94D1A			MG90V2YS50 (90 A) 2-109C1A	MG180V2YS40 (180 A) 2-109D1A			
 ES	600		MP6750 2-78A1A MP6752 2-78A1A (20 A)	MG25J6ES40 2-72A5A MG25J6ES42 2-93A2A	MG50J6ES40 2-94A2A MG50J6ES50 2-94A2A	MG75J6ES40 2-94A2A MG75J6ES50 2-94A2A	MG100J6ES40 2-94A2A MG100J6ES50 2-94A2A				
	1200	MG8Q6ES42 2-93A2A	MG15Q6ES42 2-93A2A	MG25Q6ES42 2-93A2A	MG50Q6ES1 2-94B1A MG50Q6ES40 2-94B1A						

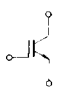



@ NON ISOLATED TYPE (TO-3P, TO-3P(L))

Red numbers indicate package codes pictured on pages 8-13.

Insulated Gate Bipolar Transistors (IGBTs)

Low Saturation Series

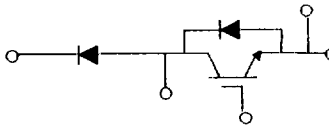
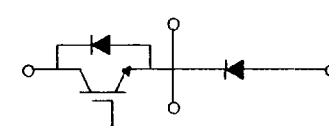
(For $f_c < 5 \text{ kHz}$)

Circuit	V _{CE} (Summ.)	Maximum Ratings									
		I _c (A)									
		25	50	75	100	150	200	300	400	500	600
 BS	600	MG25J1BS11 2-33F1A	MG50J1BS11 2-33F1A	MG75J1BS11 2-33F1A	MG100J1BS11 2-33F1A	MG150J1BS11 2-33F1A					
	1200	MG25Q1BS11 2-33D1A	MG50Q1BS11 2-33D1A	MG75Q1BS11 2-33D1A							
 US	600								MG400J1US45 2-109A4A		
	1200						MG200Q1US11 2-109A4A	MG300Q1US11 2-109A4A	MG400Q1US11 2-109A4A	MG500Q1US11 2-109A4A	MG600Q1US45 2-109A4B
 YS	600	MG25J2YS91 2-94A1A	MG50J2YS91 2-94A1A								
	1200	MG25Q2YS91 2-94D1A	MG50Q2YS91 2-94D1A	MG75J2YS45 2-94D1A	MG100J2YS45 2-94D1A	MG150J2YS45 2-95A1A	MG200J2YS45 2-95A1A	MG300J2YS45 2-109C1A	MG400J2YS45 2-109D1A		
 ES	600		MG50J6ES50 2-94A2A	MG75J6ES50 2-94A2A	MG100J6ES50 2-94A2A						
	1200		MG50Q6ES11 2-94A2A								

Red numbers indicate package codes pictured on pages 8-13.

Insulated Gate Bipolar Transistors (IGBTs)

Chopper Circuits

Circuit	V _{CE(sat)} (V)	Maximum Ratings					
		I _c (A)					
		25	50	75	100	150	200
 ZS	600		MG50J1ZS40 2-94D1A	MG75J1ZS40 2-94D1A	MG100J1ZS40 2-94D1A		
	1200				MG100Q1ZS9 2-109C1A	MG150Q1ZS9 2-109C1A	
 JS	HS			MG75Q1JS40 2-94D1A	MG100Q1JS9 2-109C1A	MG150Q1JS9 2-109C1A	MG200Q1JS9 2-109C1A
	1200						
	LS						

Red numbers indicate package codes pictured on pages 8-13.

Intelligent GTR Modules (IGM)

Type Number	V _{CE(sat)} (V)	I _c (A)	V _{CE(sat)} (MAX.)		Switching Times (MAX.)	
			(V)	I _c (A)	t _{on} (μs)	t _{off} (μs)
MIG150J201H	600	150	2.5	150	2.0	2.5
MIG200J201H	600	200	2.5	200	2.0	2.5
MIG75Q201H	1200	75	2.5	75	2.0	2.5
MIG100Q201H	1200	100	2.5	100	2.0	2.5

