IGT™ TRANSISTORS

Insulated Gate Bipolar Transistor

IGT6D11,E11

10 AMPERES
400, 500 VOLTS
EQUIV. $R_{DS(ON)}$ = 0.27 Ω

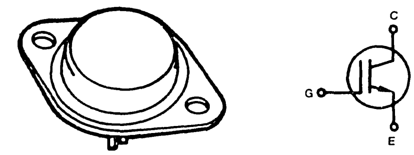
This IGT™ Transistor (Insulated Gate Bipolar Transistor) is a new type of MOS-gate turn on/off power switching device combining the best advantages of power MOSFETS and bipolar transistors. The result is a device that has the high input impedance of MOSFETS and the low on-state conduction losses similar to bipolar transistors. The device design and gate characteristics of the IGT™ Transistor are also similar to power MOSFETS. An important difference is the equivalent $R_{DS(ON)}$ drain resistance which is modulated to a low value (10 times lower) when the gate is turned on. The much lower on-state voltage drop also varies only moderately between 25° C and 150° C offering extended power handling capability.

The IGT™ Transistor is ideal for many high voltage switching applications operating at low frequencies and where low conduction losses are essential, such as; AC and DC motor controls, power supplies and drivers for solenoids, relays and contactors.

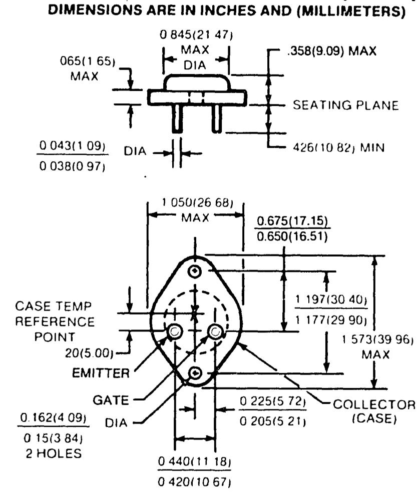
Features:

- Low $V_{CE(SAT)}$ — 2.5V typ @ 10A
- Ultra-fast turn-on — 100 ns typical
- Polysilicon MOS gate — Voltage controlled turn on/off
- High current handling — 10 amps @ 100° C

N-CHANNEL



CASE STYLE TO-204AA (TO-3)
DIMENSIONS ARE IN INCHES AND (MILLIMETERS)



maximum ratings (T_C = 25° C) (unless otherwise specified)

RATING	SYMBOL	IGT6D11	IGT6E11	UNITS
Collector-Emitter Voltage, V_{GE} = 0V	V_{CES}	400	500	Volts
Collector-Gate Voltage, R_{GE} = 1MΩ	V_{CGR}	400	500	Volts
Continuous Drain Current @ T_C = 100°C @ T_C = 25°C	I_C	10 18	10 18	A A
Pulsed Collector Current(1)	I_{CM}	40	40	A
Gate-Emitter Voltage	V_{GE}	±25	±25	Volts
Total Power Dissipation @ T_C = 25° C Derate Above 25° C	P_D	75 0.6	75 0.6	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	°C

thermal characteristics

Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.67	1.67	°C/W
Maximum Lead Temperature for Soldering Purposes: ⅛" from Case for 5 Seconds	T_L	260	260	°C

(1) Repetitive Rating: Pulse width limited by max. junction temperature.

electrical characteristics ($T_C = 25°C$) (unless otherwise specified)

CHARACTERISTIC		SYMBOL	MIN	TYP	MAX	UNIT
off characteristics						
Collector-Emitter Breakdown Voltage (V_{GE} = 0V, I_C = 250μA)	IGT6D11	BV_{CES}	400	—	—	Volts
	IGT6E11		500	—	—	
Collector Cut-off Current		I_{CES}				
(V_{CE} = Max Rating, V_{GE} = 0V, T_C = 25°C)			—	—	250	μA
(V_{CE} = Max Rating, × 0.8, V_{GE} = 0V, T_C = 150°C)(2)			—	—	4.0	mA
Gate-Emitter Leakage Current (V_{GE} = ±20V)		I_{GES}	—	—	±500	nA

(2) Applies for 3.3°C per watt maximum thermal resistance, case to ambient.

on characteristics(3)

CHARACTERISTIC		SYMBOL	MIN	TYP	MAX	UNIT
Gate Threshold Voltage (V_{CE} = V_{GE}, I_C = 250μA)	T_C = 25°C	$V_{GE(TH)}$	2	4.0	5	Volts
	T_C = 150°C		—	2.5	—	
Collector-Emitter Saturation Voltage		$V_{CE(SAT)}$				Volts
I_C = 10 A, T_C = 25°C, V_{GE} = 15V			—	2.5	2.7	
I_C = 10 A, T_C = 150°C, V_{GE} = 15V			—	2.8	—	
I_C = 10 A, T_C = 25°C, V_{GE} = 10V			—	2.9	—	

dynamic characteristics

CHARACTERISTIC	Conditions	SYMBOL	MIN	TYP	MAX	UNIT
Input Capacitance	V_{GE} = 0V	C_{ies}	—	1050	—	pF
Output Capacitance	V_{CE} = 25V	C_{oes}	—	340	—	pF
Reverse Transfer Capacitance	f = 1 MHz	C_{res}	—	10	—	pF

switching characteristics(3) (see figures 8 & 9)

CHARACTERISTIC	Conditions	SYMBOL	MIN	TYP	MAX	UNIT
Turn-on Delay Time	Resistive Load, T_C= 125°C	$t_{d(on)}$	—	100	—	ns
Rise Time	I_C = 10A, V_{CE} = Rated V_{CES}	t_r	—	100	—	ns
Turn-off Delay Time	V_{GE} = 15V	$t_{d(off)}$	—	0.4	—	μs
Fall Time	$R_{G(on)}$ = 50Ω, R_{GE} = 100Ω	t_f	—	2.5	—	μs
Turn-off Delay Time	Inductive Load, T_C = 125°C, L = 550μH, I_C = 10A,	$t_{d(off)}$	—	0.8	1.2	μs
Fall Time	$V_{CE(CLAMP)}$ = Rated V_{CES}	t_f	—	0.8	1.0	μs
Equivalent Fall Time	V_{GE} = 15V	$t_{f(eq)}$	—	0.6	0.8	μs
Turn-off Switching Losses	$R_{G(on)}$ = 50Ω, R_{GE} = 100Ω IGT6D11	E_f	—	1.3	1.6	mJ
	IGT6E11			1.6	2.0	

(3) Pulse test: Pulse widths ≤ 300 μsec, duty cycle ≤ 2%.

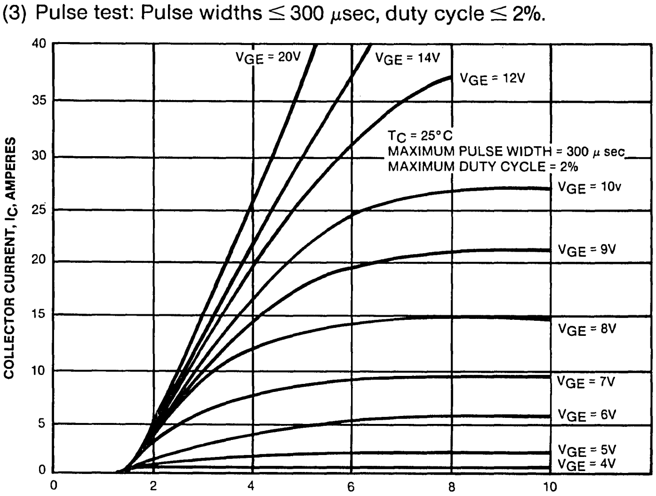


FIGURE 1. TYPICAL OUTPUT CHARACTERISTICS

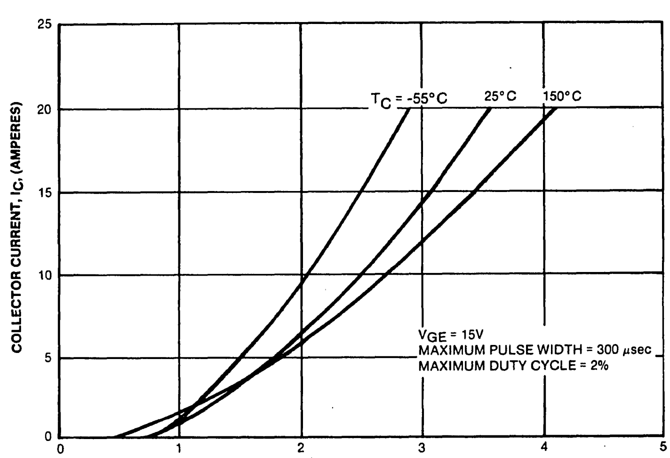


FIGURE 2. TYPICAL COLLECTOR-EMITTER SATURATION VOLTAGE

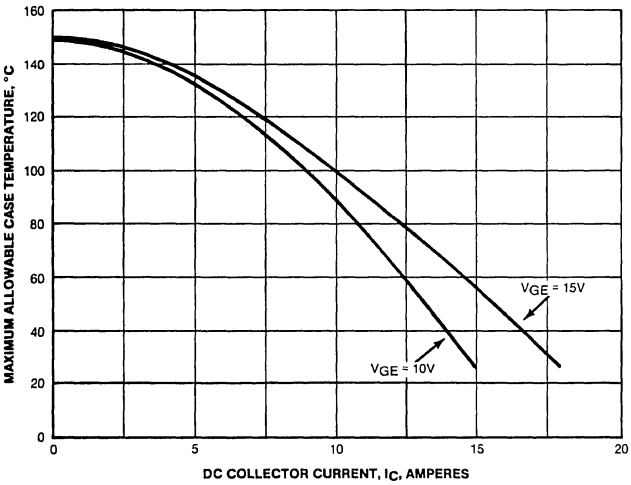


FIGURE 3. MAXIMUM ALLOWABLE CASE TEMPERATURE VS. DC COLLECTOR CURRENT

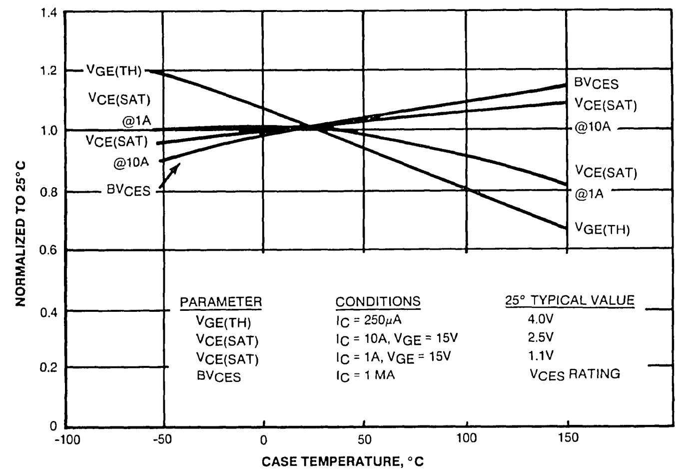


FIGURE 4. TYPICAL TEMPERATURE DEPENDENCE OF PARAMETERS

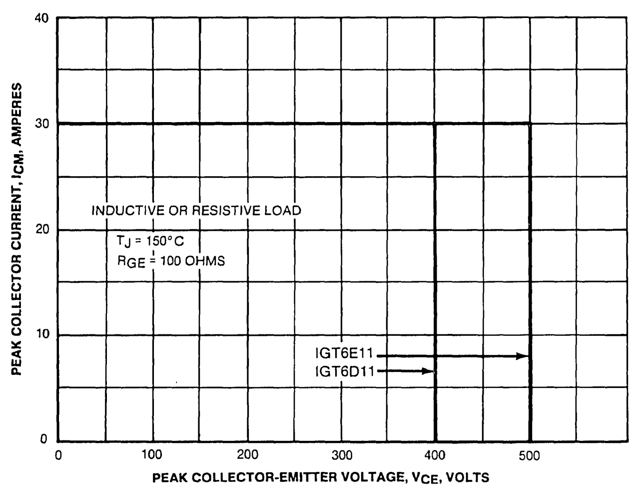


FIGURE 5. TURN-OFF SAFE OPERATING AREA

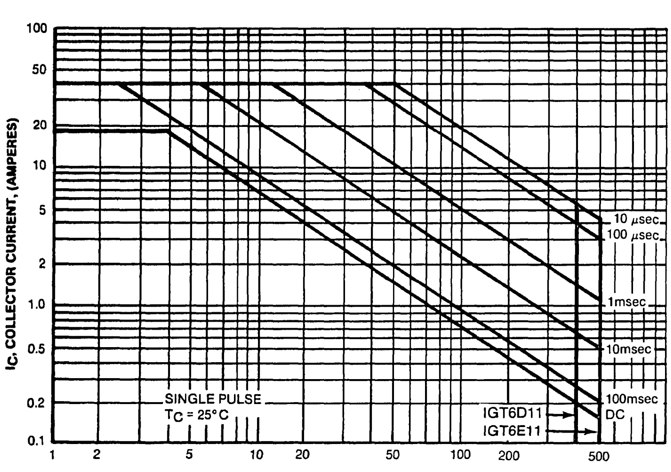


FIGURE 6. TURN-ON SAFE OPERATING AREA

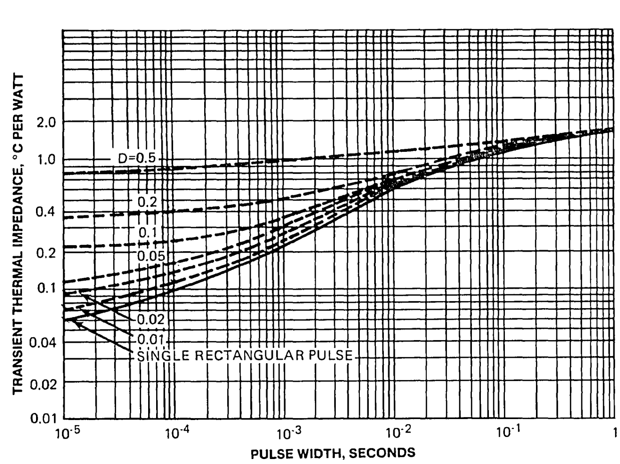
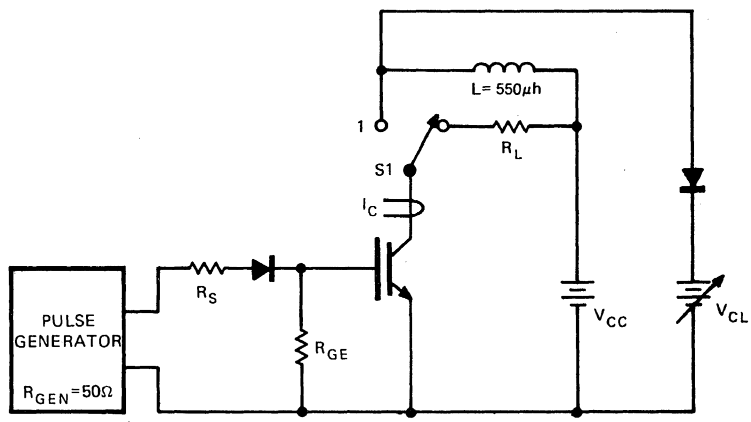


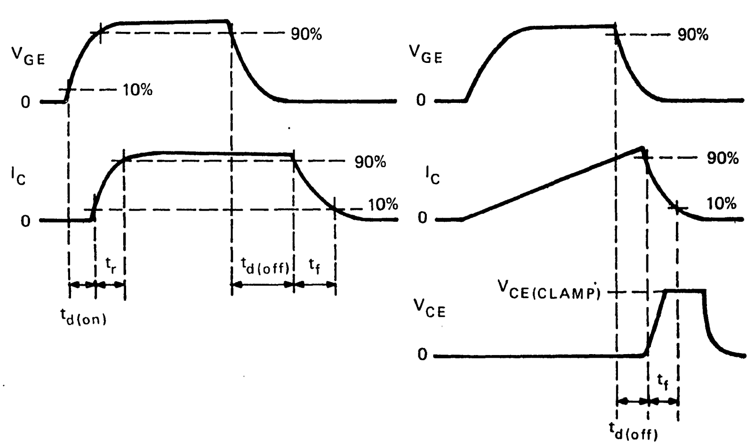
FIGURE 7. MAXIMUM TRANSIENT THERMAL IMPEDANCE



S1 (SWITCH POSITION) –1 CLAMPED INDUCTIVE LOAD
–2 RESISTIVE LOAD

$$R_{G(ON)} = \frac{(R_{GEN}+R_S)(R_{GE})}{R_{GEN}+R_S+R_{GE}}, \text{ PULSE WIDTH} \geq 60\mu\text{sec}, \ V_{CC} = \frac{L \cdot I_{C(MAXIMUM)}}{\text{PULSE WIDTH}}$$

FIGURE 8. BASIC SWITCHING TEST CIRCUIT



RESISTIVE LOAD INDUCTIVE LOAD

(WAVEFORMS NOT TO SCALE)

FIGURE 9. SWITCHING WAVEFORMS