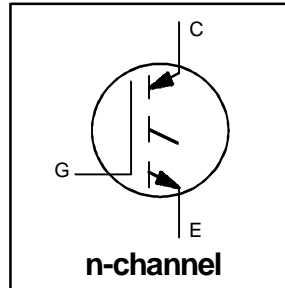


INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated
UltraFast Fast IGBT

Features

- Short circuit rated - $10\mu\text{s}$ @ 125°C , $V_{GE} = 15\text{V}$
- Switching-loss rating includes all "tail" losses
- Optimized for high operating frequency (over 5kHz)
See Fig. 1 for Current vs. Frequency curve

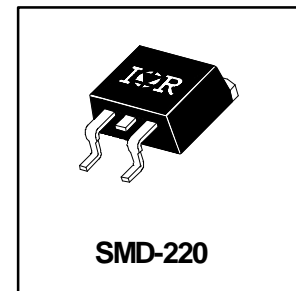


$V_{CES} = 600\text{V}$
$V_{CE(sat)} \leq 3.8\text{V}$
@ $V_{GE} = 15\text{V}$, $I_C = 14\text{A}$

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.

These new short circuit rated devices are especially suited for motor control and other applications requiring short circuit withstand capability.



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	23	A
$I_C @ T_C = 100^\circ\text{C}$	Continuous Collector Current	14	
I_{CM}	Pulsed Collector Current ①	46	
I_{LM}	Clamped Inductive Load Current ②	46	
t_{sc}	Short Circuit Withstand Time	10	μs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	10	mJ
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	100	W
$P_D @ T_C = 100^\circ\text{C}$	Maximum Power Dissipation	42	
T_J	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.2	°C/W
$R_{\theta JA}$	Junction-to-Ambient, (PCB mount)**	—	—	40	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	80	
Wt	Weight	—	2 (0.07)	—	g (oz)

** When mounted on 1" square PCB (FR-4 or G-10 Material)

For recommended footprint and soldering techniques refer to application note #AN-994.

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)CES}	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V _{GE} = 0V, I _C = 250μA
V _{(BR)ECS}	Emitter-to-Collector Breakdown Voltage ④	20	—	—	V	V _{GE} = 0V, I _C = 1.0A
ΔV _{(BR)CES/ΔT_J}	Temperature Coeff. of Breakdown Voltage	—	0.30	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(on)}	Collector-to-Emitter Saturation Voltage	—	2.5	3.8	V	I _C = 14A V _{GE} = 15V
		—	3.3	—		I _C = 23A See Fig. 2, 5
		—	2.5	—		I _C = 14A, T _J = 150°C
V _{GE(th)}	Gate Threshold Voltage	3.0	—	5.5		V _{CE} = V _{GE} , I _C = 250μA
ΔV _{GE(th)/ΔT_J}	Temperature Coeff. of Threshold Voltage	—	-13	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ⑤	3.3	6.5	—	S	V _{CE} = 100V, I _C = 14A
I _{CES}	Zero Gate Voltage Collector Current	—	—	600	μA	V _{GE} = 0V, V _{CE} = 600V
		—	—	1100		V _{GE} = 0V, V _{CE} = 600V, T _J = 150°C
I _{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V _{GE} = ±20V

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q _g	Total Gate Charge (turn-on)	—	39	58	nC	I _C = 14A V _{CC} = 400V See Fig. 8 V _{GE} = 15V
Q _{ge}	Gate - Emitter Charge (turn-on)	—	8.7	13		
Q _{gc}	Gate - Collector Charge (turn-on)	—	15	23		
t _{d(on)}	Turn-On Delay Time	—	31	—	ns	T _J = 25°C I _C = 14A, V _{CC} = 480V V _{GE} = 15V, R _G = 23Ω Energy losses include "tail"
t _r	Rise Time	—	23	—		
t _{d(off)}	Turn-Off Delay Time	—	100	150		
t _f	Fall Time	—	84	130		
E _{on}	Turn-On Switching Loss	—	0.3	—	mJ	See Fig. 9, 10, 11, 14
E _{off}	Turn-Off Switching Loss	—	0.3	—		
E _{ts}	Total Switching Loss	—	0.6	0.9		
t _{sc}	Short Circuit Withstand Time	10	—	—	μs	V _{CC} = 360V, T _J = 125°C V _{GE} = 15V, R _G = 23Ω, V _{CPK} < 500V
t _{d(on)}	Turn-On Delay Time	—	30	—	ns	T _J = 150°C, I _C = 14A, V _{CC} = 480V V _{GE} = 15V, R _G = 23Ω Energy losses include "tail"
t _r	Rise Time	—	23	—		
t _{d(off)}	Turn-Off Delay Time	—	170	—		
t _f	Fall Time	—	170	—		
E _{ts}	Total Switching Loss	—	1.2	—	mJ	See Fig. 10, 14
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	740	—	pF	V _{GE} = 0V V _{CC} = 30V See Fig. 7 f = 1.0MHz
C _{oes}	Output Capacitance	—	92	—		
C _{res}	Reverse Transfer Capacitance	—	9.4	—		

Notes:

- ① Repetitive rating; V_{GE}=20V, pulse width limited by max. junction temperature. (See fig. 13b)
- ② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10μH, R_G= 23Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.

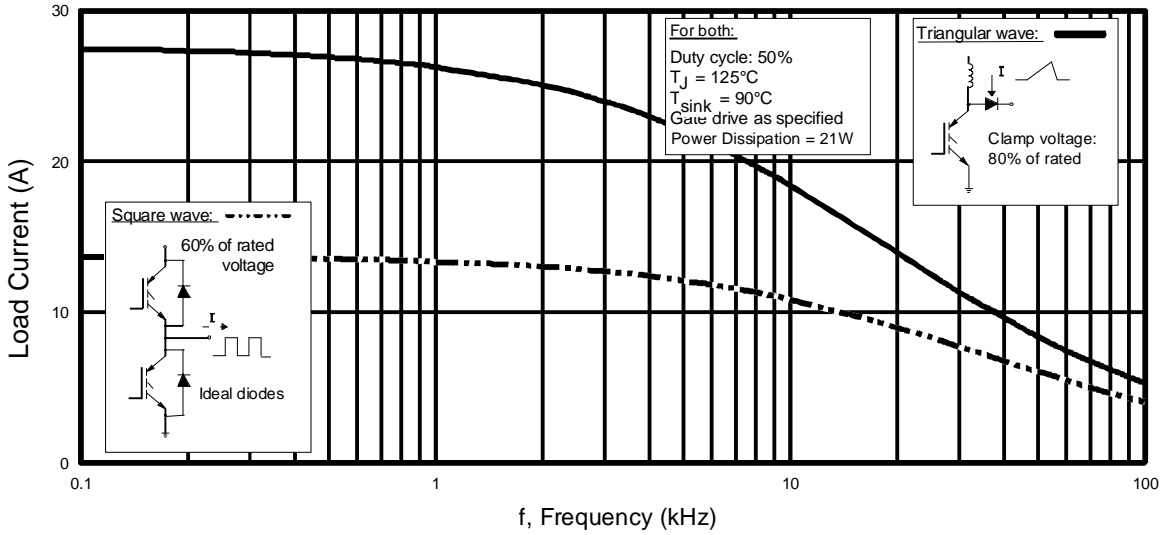


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

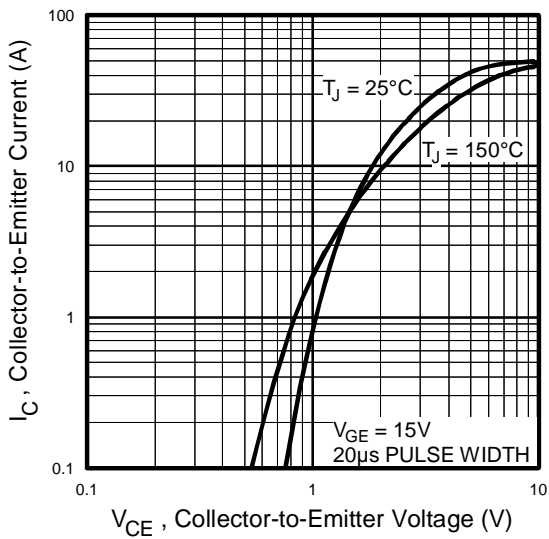


Fig. 2 - Typical Output Characteristics

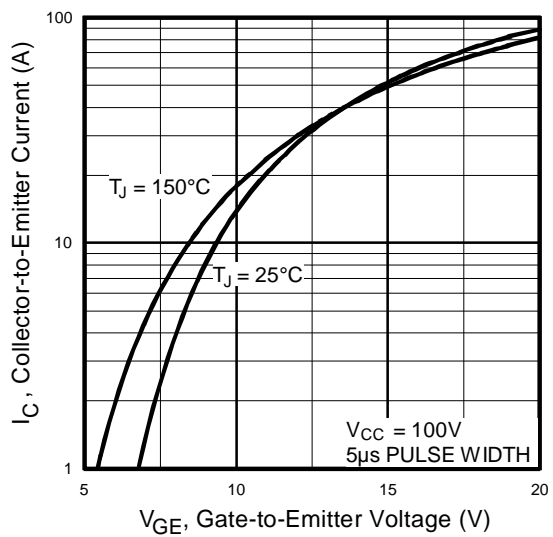


Fig. 3 - Typical Transfer Characteristics

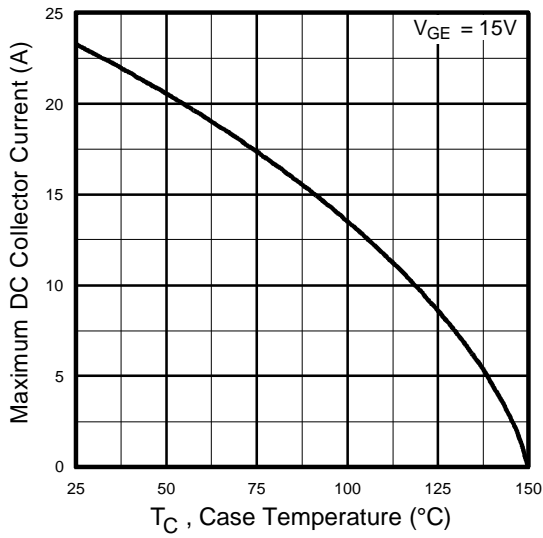


Fig. 4 - Maximum Collector Current vs. Case Temperature

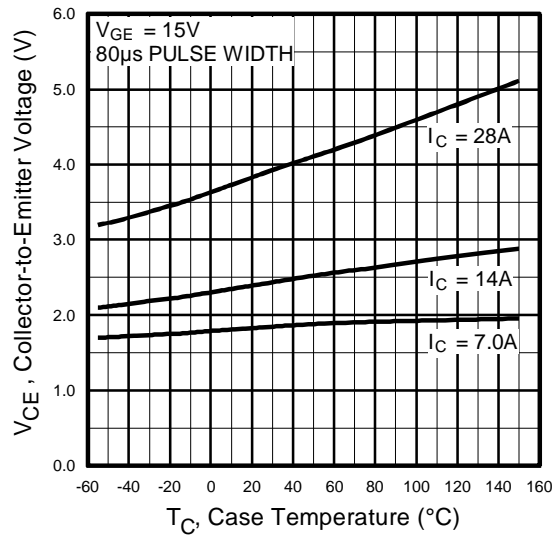


Fig. 5 - Collector-to-Emitter Voltage vs. Case Temperature

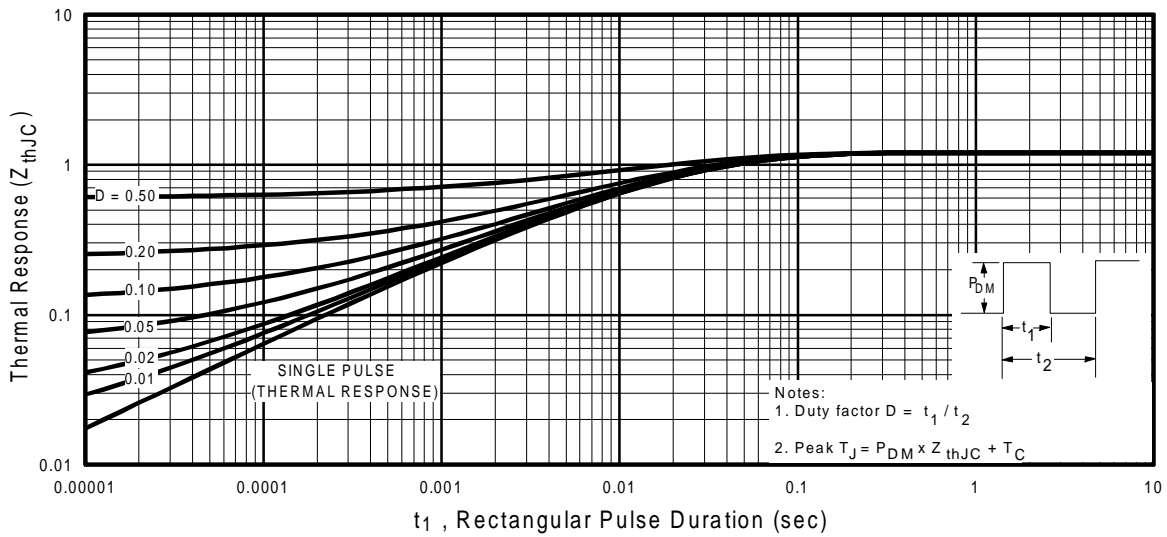


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

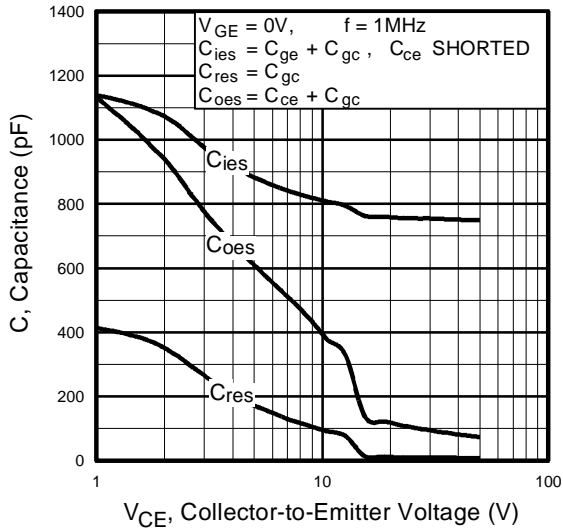


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

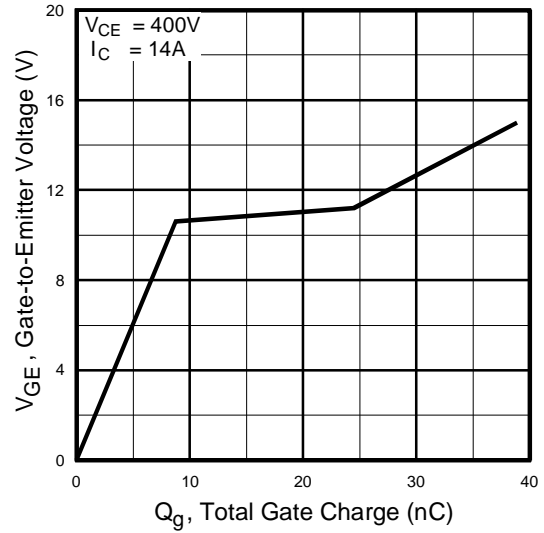


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

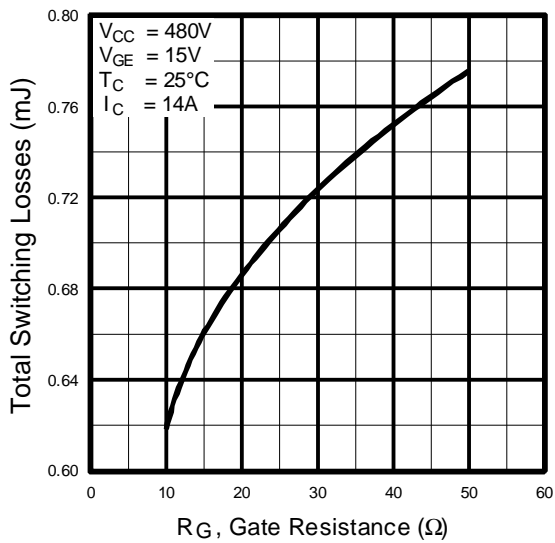


Fig. 9 - Typical Switching Losses vs. Gate Resistance

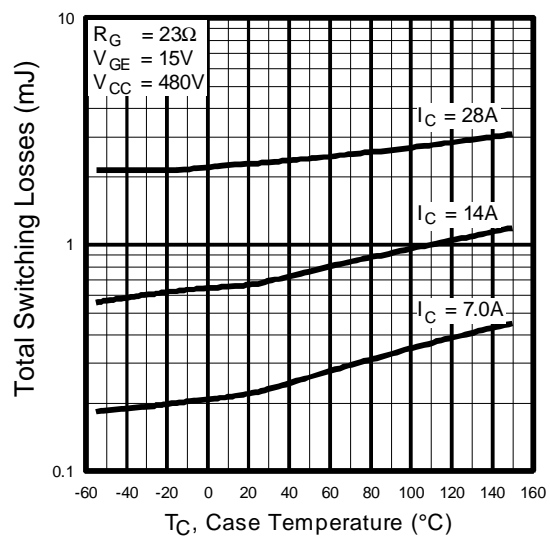


Fig. 10 - Typical Switching Losses vs. Case Temperature

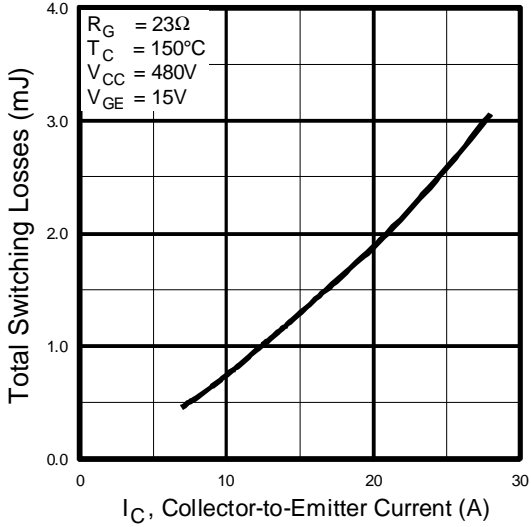


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

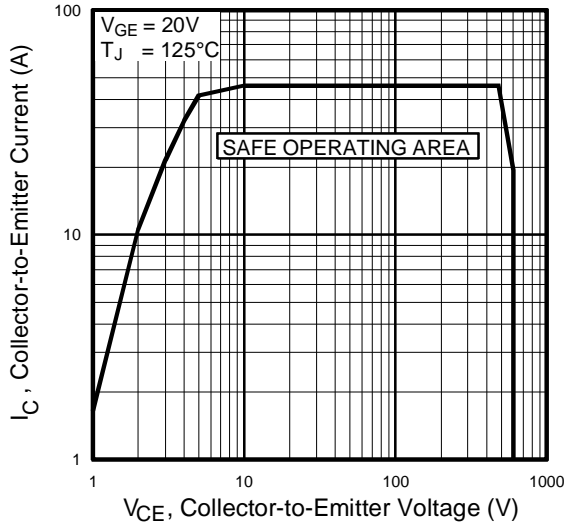


Fig. 12 - Turn-Off SOA

Refer to **Section D** for the following:

Appendix C: Section D - page D-5

- Fig. 13a - Clamped Inductive Load Test Circuit
- Fig. 13b - Pulsed Collector Current Test Circuit
- Fig. 14a - Switching Loss Test Circuit
- Fig. 14b - Switching Loss Waveform