

Designer's™ Data Sheet

Insulated Gate Bipolar Transistor with Anti-Parallel Diode

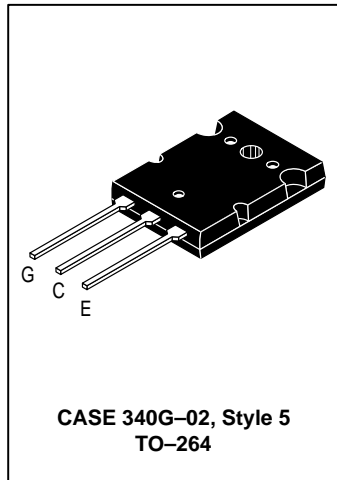
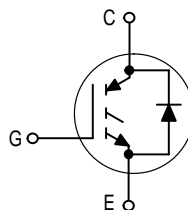
N-Channel Enhancement-Mode Silicon Gate

MGY30N60D
Motorola Preferred Device

IGBT & DIODE IN TO-264
30 A @ 90°C
50 A @ 25°C
600 VOLTS
SHORT CIRCUIT RATED

This Insulated Gate Bipolar Transistor (IGBT) is co-packaged with a soft recovery ultra-fast rectifier and uses an advanced termination scheme to provide an enhanced and reliable high voltage-blocking capability. Short circuit rated IGBT's are specifically suited for applications requiring a guaranteed short circuit withstand time such as Motor Control Drives. Fast switching characteristics result in efficient operations at high frequencies. Co-packaged IGBT's save space, reduce assembly time and cost.

- Industry Standard High Power TO-264 Package (TO-3PBL)
- High Speed E_{off} : 60 μ J per Amp typical at 125°C
- High Short Circuit Capability – 10 μ s minimum
- Soft Recovery Free Wheeling Diode is included in the package
- Robust High Voltage Termination
- Robust RBSOA



MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	600	Vdc
Collector-Gate Voltage ($R_{GE} = 1.0 \text{ M}\Omega$)	V_{CGR}	600	Vdc
Gate-Emitter Voltage — Continuous	V_{GE}	± 20	Vdc
Collector Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 90^\circ\text{C}$ — Repetitive Pulsed Current (1)	I_{C25} I_{C90} I_{CM}	50 30 100	Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	202 1.61	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150	°C
Short Circuit Withstand Time ($V_{CC} = 360 \text{ Vdc}, V_{GE} = 15 \text{ Vdc}, T_J = 25^\circ\text{C}, R_G = 20 \Omega$)	t_{sc}	10	μ s
Thermal Resistance — Junction to Case – IGBT — Junction to Case – Diode — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JC}$ $R_{\theta JA}$	0.62 1.41 35	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	260	°C
Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.13 N•m)		

(1) Pulse width is limited by maximum junction temperature.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Preferred devices are Motorola recommended choices for future use and best overall value.

MGY30N60D

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-to-Emitter Breakdown Voltage (V _{GE} = 0 Vdc, I _C = 250 μAdc) Temperature Coefficient (Positive)	BV _{CES}	600 —	— 870	— —	Vdc mV/°C
Zero Gate Voltage Collector Current (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc) (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc, T _J = 125°C)	I _{CES}	— —	— —	100 2500	μAdc
Gate-Body Leakage Current (V _{GE} = ± 20 Vdc, V _{CE} = 0 Vdc)	I _{GES}	—	—	250	nAdc

ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage (V _{GE} = 15 Vdc, I _C = 15 Adc) (V _{GE} = 15 Vdc, I _C = 15 Adc, T _J = 125°C) (V _{GE} = 15 Vdc, I _C = 30 Adc)	V _{CE(on)}	— — —	2.20 2.10 2.60	2.90 — 3.45	Vdc
Gate Threshold Voltage (V _{CE} = V _{GE} , I _C = 1 mAdc) Threshold Temperature Coefficient (Negative)	V _{GE(th)}	4.0 —	6.0 10	8.0 —	Vdc mV/°C
Forward Transconductance (V _{CE} = 10 Vdc, I _C = 30 Adc)	g _{fe}	—	15	—	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{CE} = 25 Vdc, V _{GE} = 0 Vdc, f = 1.0 MHz)	C _{ies}	—	4280	—	pF
Output Capacitance		C _{oes}	—	225	—	
Transfer Capacitance		C _{res}	—	19	—	

SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 25°C) Energy losses include "tail"	t _{d(on)}	—	76	—	ns	
Rise Time		t _r	—	80	—		
Turn-Off Delay Time		t _{d(off)}	—	348	—		
Fall Time			t _f	—	188	—	mJ
Turn-Off Switching Loss		E _{off}	—	0.98	1.28		
Turn-On Switching Loss		E _{on}	—	2.00	—		
Total Switching Loss		E _{ts}	—	2.98	—		
Turn-On Delay Time	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 125°C) Energy losses include "tail"	t _{d(on)}	—	73	—	ns	
Rise Time		t _r	—	95	—		
Turn-Off Delay Time		t _{d(off)}	—	394	—		
Fall Time			t _f	—	418	—	mJ
Turn-Off Switching Loss		E _{off}	—	1.90	—		
Turn-On Switching Loss		E _{on}	—	3.10	—		
Total Switching Loss		E _{ts}	—	5.00	—		
Gate Charge	(V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc)	Q _T	—	150	—	nC	
		Q ₁	—	30	—		
		Q ₂	—	45	—		

DIODE CHARACTERISTICS

Diode Forward Voltage Drop (I _{EC} = 15 Adc) (I _{EC} = 15 Adc, T _J = 125°C) (I _{EC} = 30 Adc)	V _{FEC}	— — —	1.30 1.10 1.45	1.80 — 2.05	Vdc
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(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

(continued)

ELECTRICAL CHARACTERISTICS — continued ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit	
DIODE CHARACTERISTICS — continued						
Reverse Recovery Time	$(I_F = 30 \text{ Adc}, V_R = 360 \text{ Vdc}, \text{d}I_F/\text{d}t = 200 \text{ A}/\mu\text{s})$	t_{rr}	—	153	—	ns
		t_a	—	82	—	
		t_b	—	71	—	
Reverse Recovery Stored Charge	Q_{RR}	—	2.3	—	μC	
Reverse Recovery Time	$(I_F = 30 \text{ Adc}, V_R = 360 \text{ Vdc}, \text{d}I_F/\text{d}t = 200 \text{ A}/\mu\text{s}, T_J = 125^\circ\text{C})$	t_{rr}	—	208	—	ns
		t_a	—	117	—	
		t_b	—	91	—	
Reverse Recovery Stored Charge	Q_{RR}	—	3.8	—	μC	
INTERNAL PACKAGE INDUCTANCE						
Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)	L_E	—	13	—	nH	

TYPICAL ELECTRICAL CHARACTERISTICS

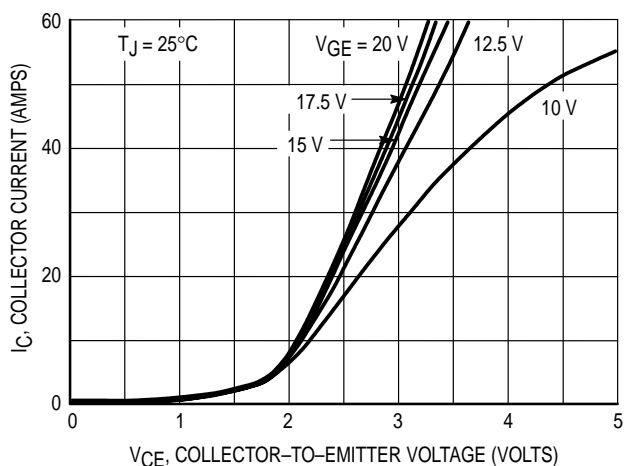


Figure 1. Output Characteristics, $T_J = 25^\circ\text{C}$

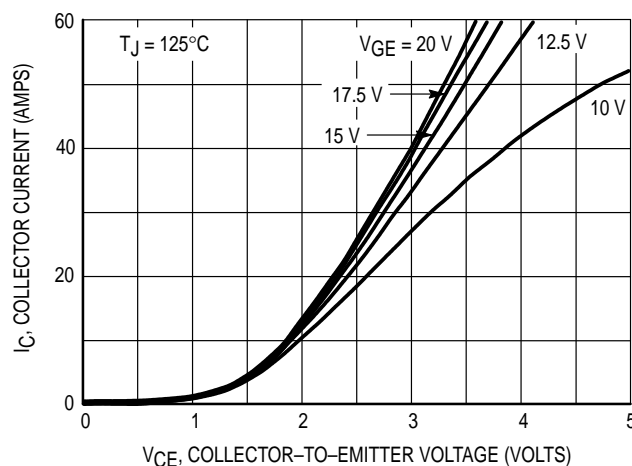


Figure 2. Output Characteristics, $T_J = 125^\circ\text{C}$

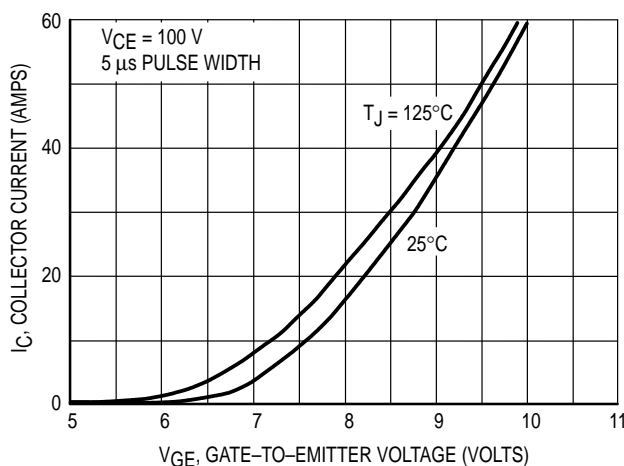


Figure 3. Transfer Characteristics

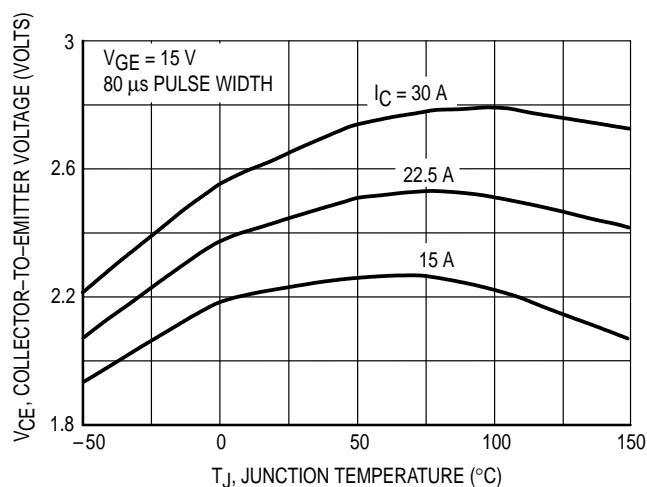


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

MGY30N60D

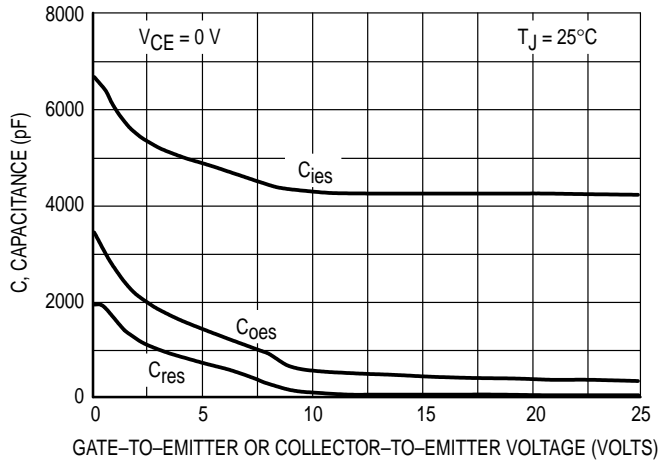


Figure 5. Capacitance Variation

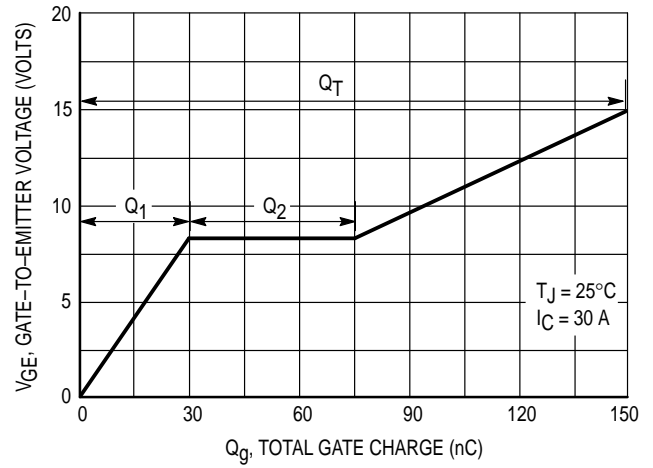


Figure 6. Gate-to-Emitter Voltage versus Total Charge

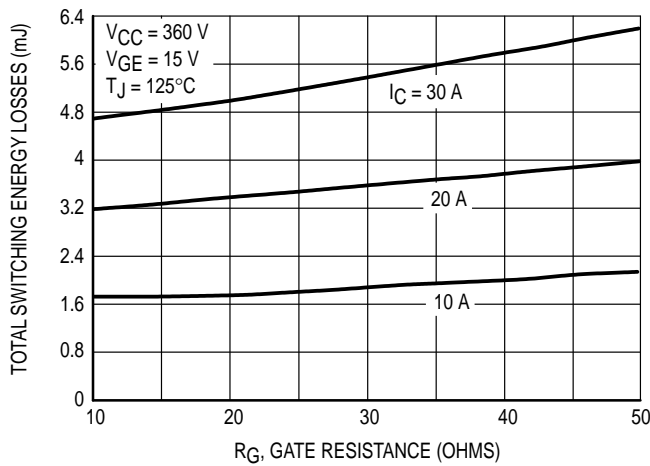


Figure 7. Total Switching Losses versus Gate Resistance

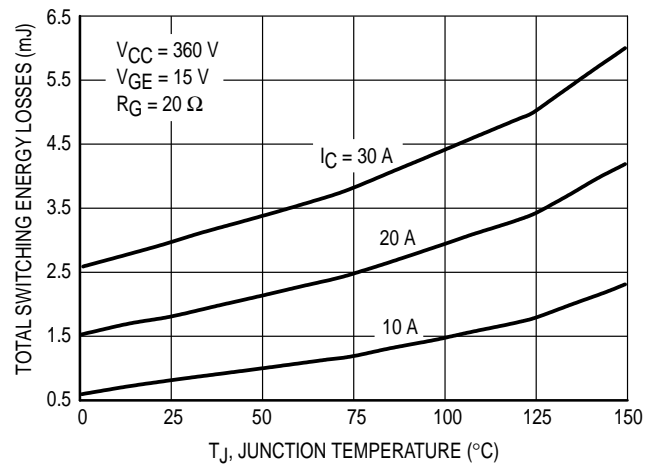


Figure 8. Total Switching Losses versus Junction Temperature

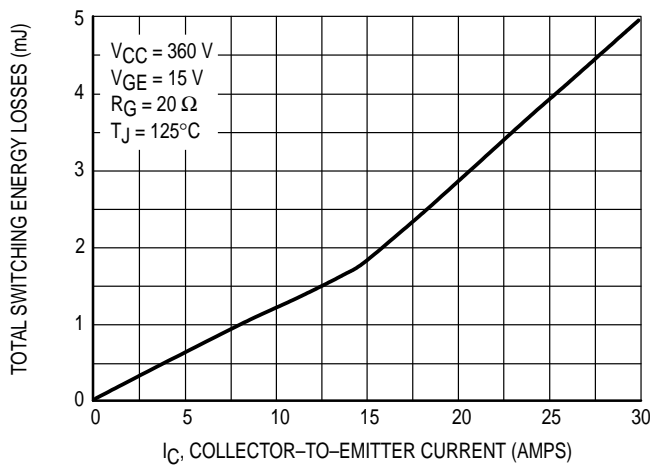


Figure 9. Total Switching Losses versus Collector-to-Emitter Current

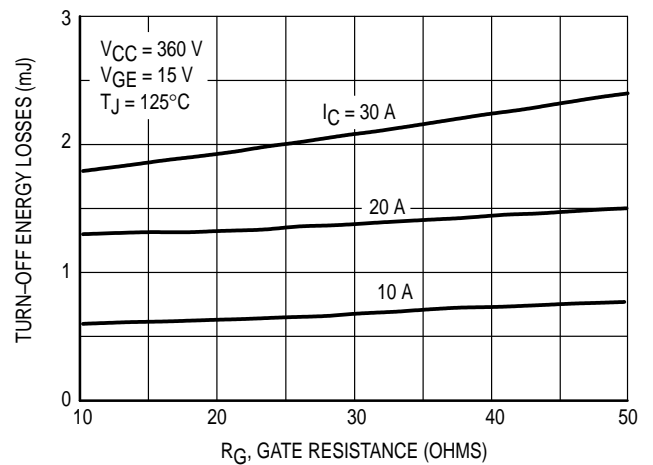


Figure 10. Turn-Off Losses versus Gate Resistance

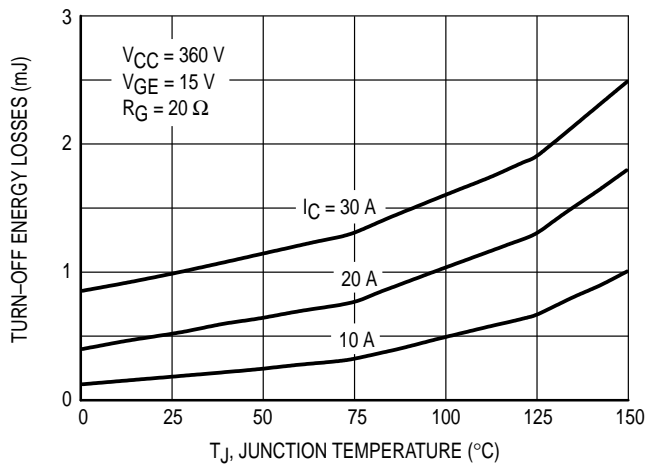


Figure 11. Turn-Off Losses versus Junction Temperature

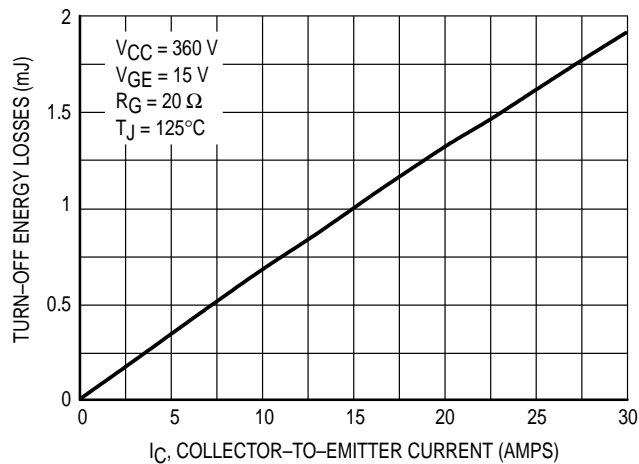


Figure 12. Turn-Off Losses versus Collector-to-Emitter Current

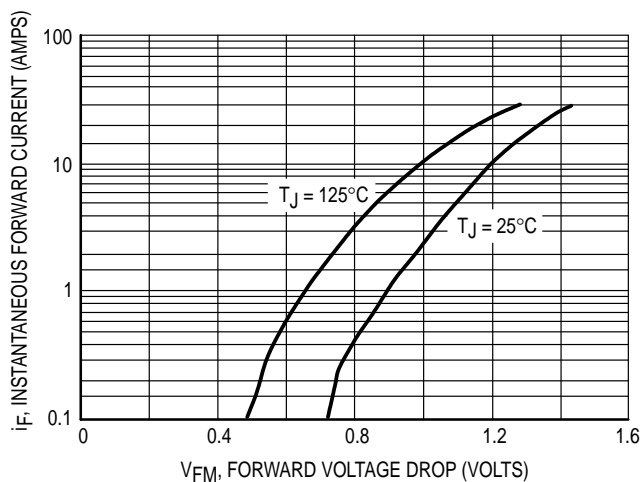


Figure 13. Typical Diode Forward Drop versus Instantaneous Forward Current

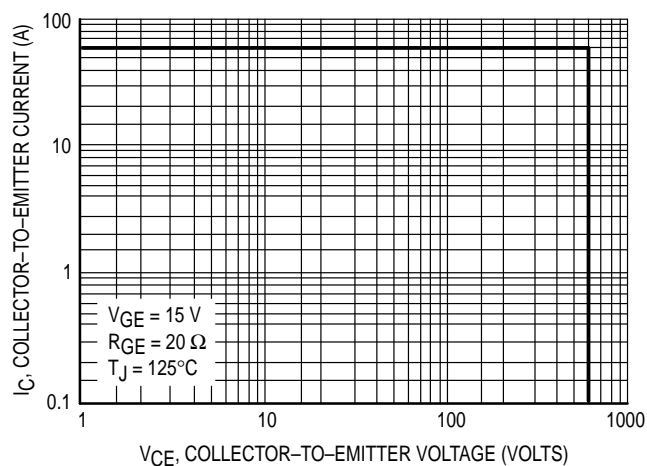
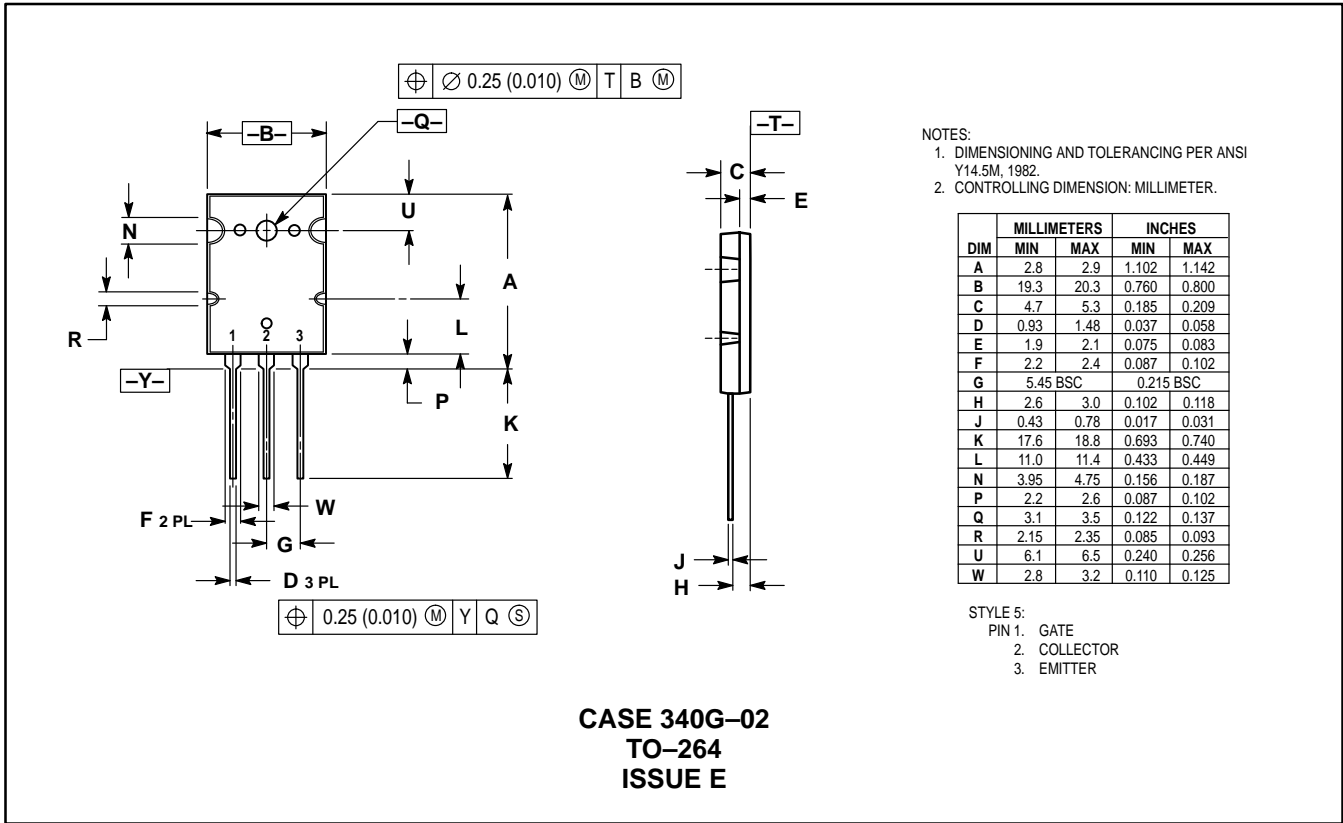


Figure 14. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS



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