

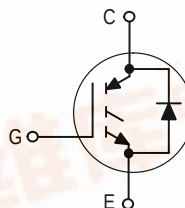
Designer's™ Data Sheet

Insulated Gate Bipolar Transistor with Anti-Parallel Diode

N-Channel Enhancement-Mode Silicon Gate

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 operation at high frequencies. Co-packaged IGBT's save space, reduce assembly time and cost.

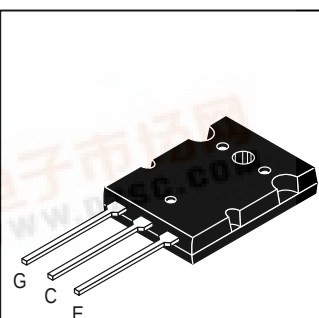
- Industry Standard High Power TO-264 Package (TO-3PBL)
- High Speed E_{off} : 226 μ J per Amp typical at 125°C
- High Short Circuit Capability – 10 μ s minimum
- Soft Recovery Free Wheeling Diode is included in the package
- Robust High Voltage Termination
- Robust RBSOA



MGY25N120D

Motorola Preferred Device

IGBT & DIODE IN TO-264
25 A @ 90°C
38 A @ 25°C
1200 VOLTS
SHORT CIRCUIT RATED



CASE 340G-02, Style 5
TO-264

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

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	1200	Vdc
Collector-Gate Voltage ($R_{GE} = 1.0 \text{ M}\Omega$)	V_{CGR}	1200	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}	38 25 76	Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	212 1.69	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150	°C
Short Circuit Withstand Time ($V_{CC} = 720 \text{ Vdc}$, $V_{GE} = 15 \text{ Vdc}$, $T_J = 125^\circ\text{C}$, $R_G = 20 \Omega$)	t_{sc}	10	μ s
Thermal Resistance — Junction to Case — IGBT — Junction to Case — Diode — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JC}$ $R_{\theta JA}$	0.6 0.9 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. Repetitive rating.

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.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-to-Emitter Breakdown Voltage ($V_{GE} = 0\text{ Vdc}$, $I_C = 25\text{ }\mu\text{Adc}$) Temperature Coefficient (Positive)	BV_{CES}	1200 —	— 960	— —	Vdc mV/ $^\circ\text{C}$
Zero Gate Voltage Collector Current ($V_{CE} = 1200\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$) ($V_{CE} = 1200\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$, $T_J = 125^\circ\text{C}$)	I_{CES}	— —	— —	100 2500	μAdc
Gate-Body Leakage Current ($V_{GE} = \pm 20\text{ Vdc}$, $V_{CE} = 0\text{ Vdc}$)	I_{GES}	—	—	250	nAdc

ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage ($V_{GE} = 15\text{ Vdc}$, $I_C = 12.5\text{ Adc}$) ($V_{GE} = 15\text{ Vdc}$, $I_C = 12.5\text{ Adc}$, $T_J = 125^\circ\text{C}$) ($V_{GE} = 15\text{ Vdc}$, $I_C = 25\text{ Adc}$)	$V_{CE(on)}$	— — —	2.37 2.15 2.98	3.24 — 4.19	Vdc
Gate Threshold Voltage ($V_{CE} = V_{GE}$, $I_C = 1.0\text{ mAdc}$) Threshold Temperature Coefficient (Negative)	$V_{GE(th)}$	4.0 —	6.0 10	8.0 —	Vdc mV/ $^\circ\text{C}$
Forward Transconductance ($V_{CE} = 10\text{ Vdc}$, $I_C = 20\text{ Adc}$)	g_{fe}	—	12	—	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{CE} = 25\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$, $f = 1.0\text{ MHz}$)	C_{ies}	—	1859	—	pF
Output Capacitance		C_{oes}	—	198	—	
Transfer Capacitance		C_{res}	—	30	—	

SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	$(V_{CC} = 720\text{ Vdc}$, $I_C = 25\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$, $L = 300\text{ }\mu\text{H}$ $R_G = 20\text{ }\Omega$, $T_J = 25^\circ\text{C}$) Energy losses include "tail"	$t_{d(on)}$	—	91	—	ns
Rise Time		t_r	—	124	—	
Turn-Off Delay Time		$t_{d(off)}$	—	196	—	
Fall Time		t_f	—	310	—	
Turn-Off Switching Loss		E_{off}	—	2.44	4.69	mJ
Turn-On Switching Loss		E_{on}	—	3.14	9.69	
Total Switching Loss		E_{ts}	—	5.58	14.38	
Turn-On Delay Time	$(V_{CC} = 720\text{ Vdc}$, $I_C = 25\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$, $L = 300\text{ }\mu\text{H}$ $R_G = 20\text{ }\Omega$, $T_J = 125^\circ\text{C}$) Energy losses include "tail"	$t_{d(on)}$	—	88	—	ns
Rise Time		t_r	—	126	—	
Turn-Off Delay Time		$t_{d(off)}$	—	236	—	
Fall Time		t_f	—	640	—	
Turn-Off Switching Loss		E_{off}	—	5.40	—	mJ
Turn-On Switching Loss		E_{on}	—	5.03	—	
Total Switching Loss		E_{ts}	—	10.43	—	
Gate Charge	$(V_{CC} = 720\text{ Vdc}$, $I_C = 25\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$)	Q_T	—	62	—	nC
		Q_1	—	22	—	
		Q_2	—	25	—	

DIODE CHARACTERISTICS

Diode Forward Voltage Drop ($I_{EC} = 12.5\text{ Adc}$) ($I_{EC} = 12.5\text{ Adc}$, $T_J = 125^\circ\text{C}$) ($I_{EC} = 25\text{ Adc}$)	V_{FEC}	— — —	2.89 1.75 3.65	3.50 — 4.45	Vdc
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(1) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
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DIODE CHARACTERISTICS — continued

Reverse Recovery Time	$(I_F = 25 \text{ Adc}, V_R = 720 \text{ Vdc}, dI_F/dt = 150 \text{ A}/\mu\text{s})$	t_{rr}	—	114	—	ns
		t_a	—	71	—	
		t_b	—	43	—	
Reverse Recovery Stored Charge		Q_{RR}	—	0.65	—	μC
Reverse Recovery Time	$(I_F = 25 \text{ Adc}, V_R = 720 \text{ Vdc}, dI_F/dt = 150 \text{ A}/\mu\text{s}, T_J = 125^\circ\text{C})$	t_{rr}	—	226	—	ns
		t_a	—	165	—	
		t_b	—	61	—	
Reverse Recovery Stored Charge		Q_{RR}	—	1.90	—	μC

INTERNAL PACKAGE INDUCTANCE

Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)	L_E	—	13	—	nH
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TYPICAL ELECTRICAL CHARACTERISTICS

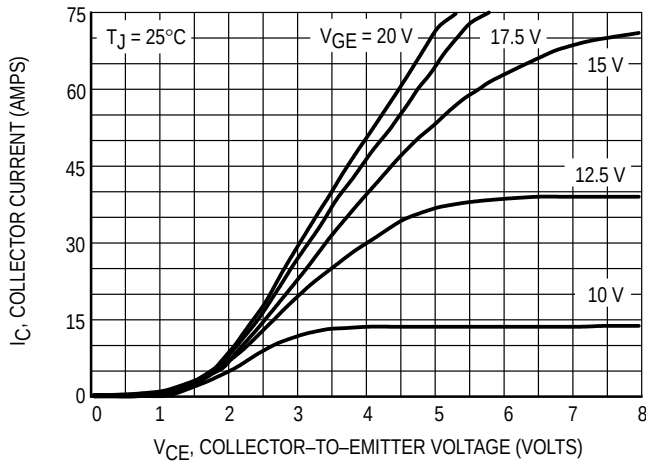


Figure 1. Output Characteristics, $T_J = 25^\circ\text{C}$

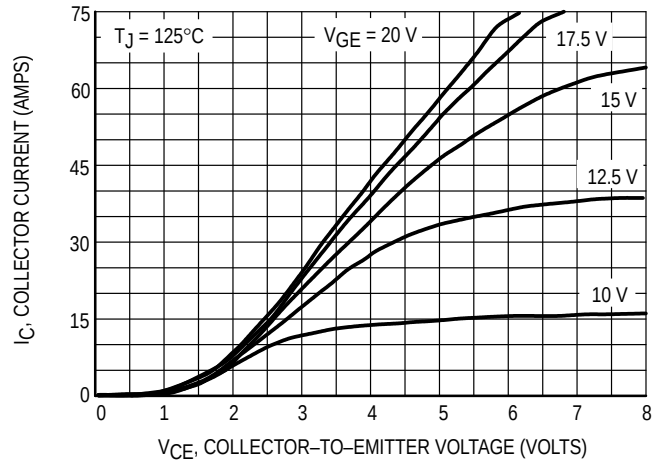


Figure 2. Output Characteristics, $T_J = 125^\circ\text{C}$

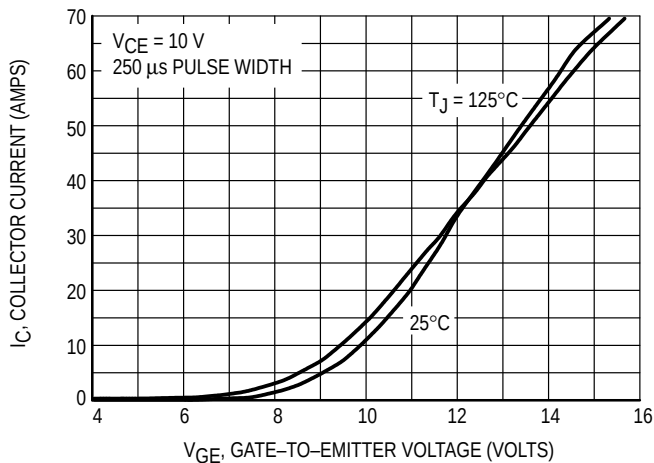


Figure 3. Transfer Characteristics

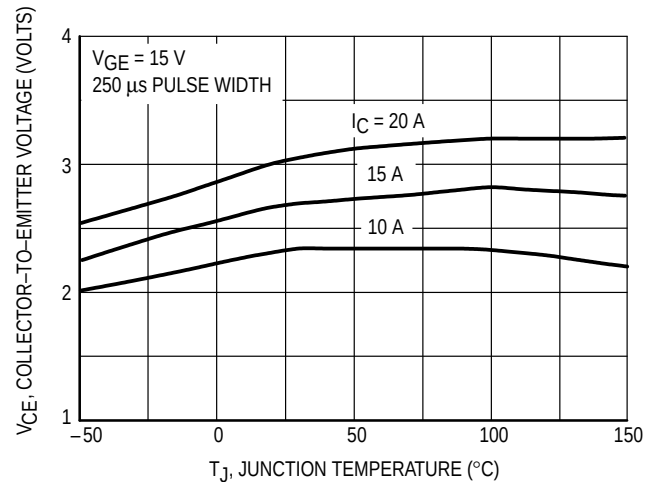


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

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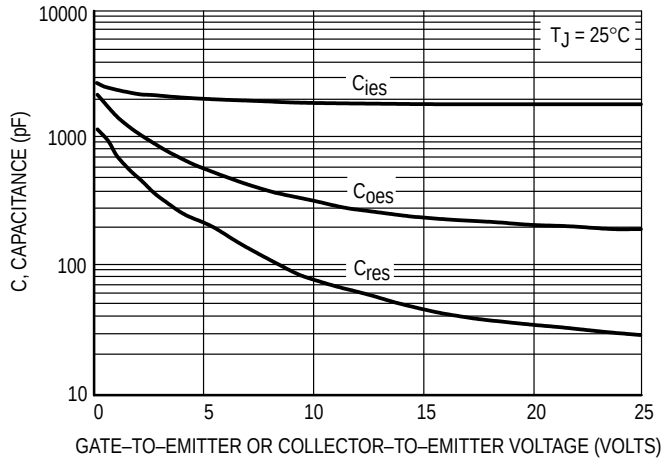


Figure 5. Capacitance Variation

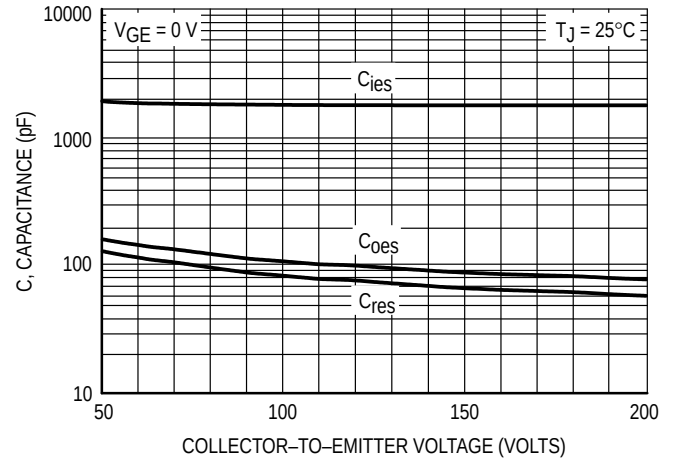


Figure 5b. High Voltage Capacitance Variation

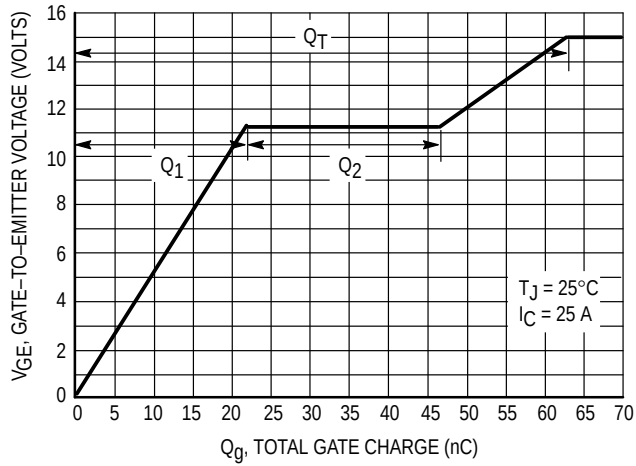


Figure 6. Gate-to-Emitter and Collector-to-Emitter Voltage versus Total Charge

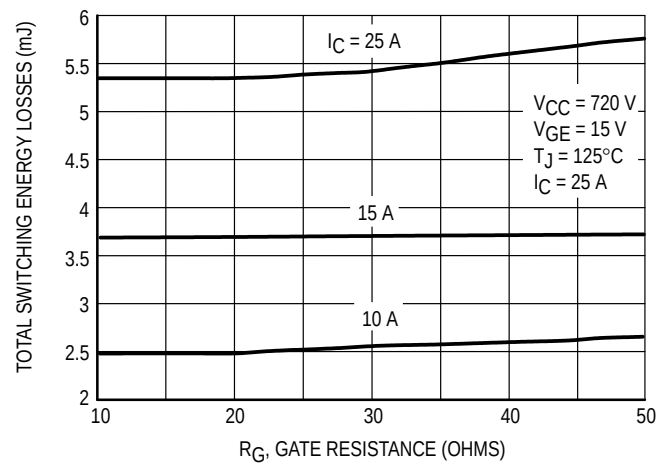


Figure 7. Total Switching Losses versus Gate Resistance

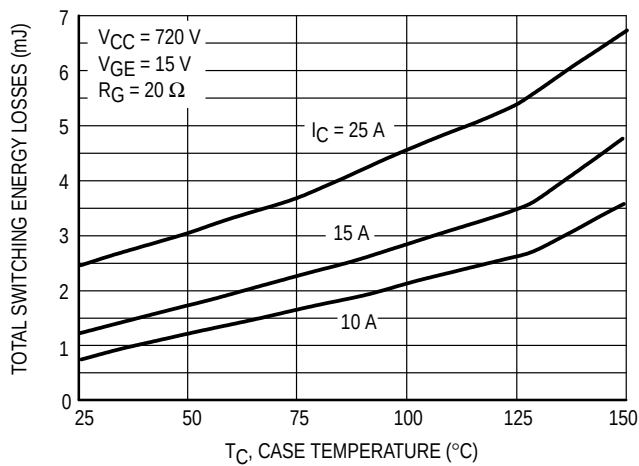


Figure 8. Total Switching Losses versus Case Temperature

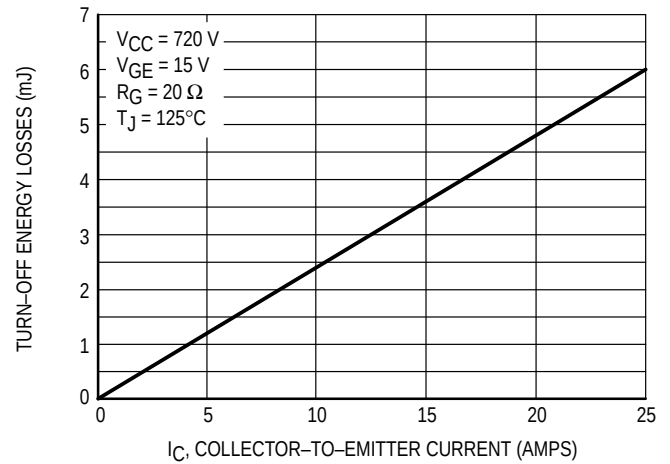


Figure 9. Turn-Off Losses versus Collector-to-Emitter Current

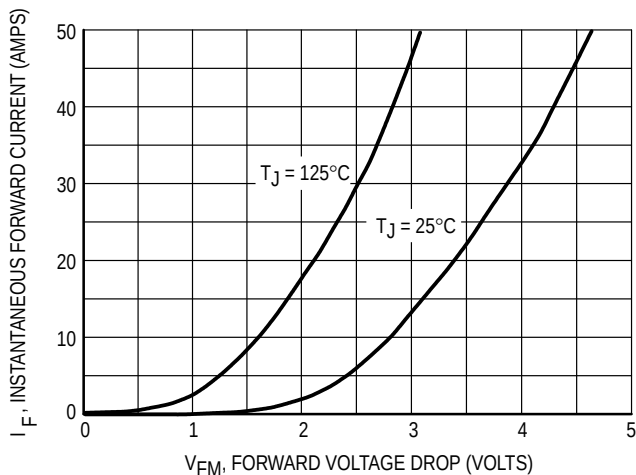


Figure 10. Maximum Forward Drop versus Instantaneous Forward Current

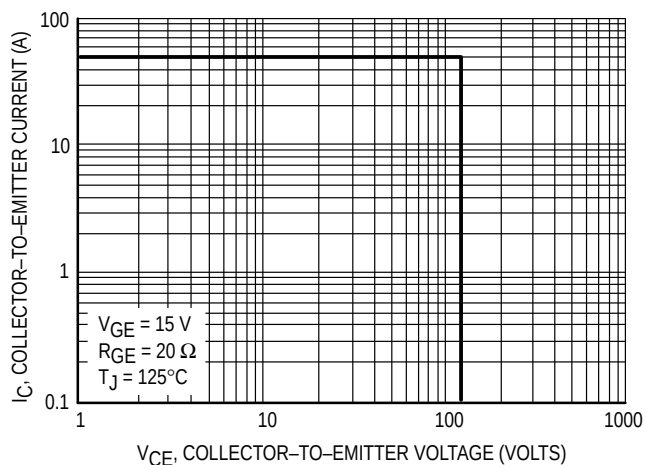


Figure 11. Reverse Biased Safe Operating Area

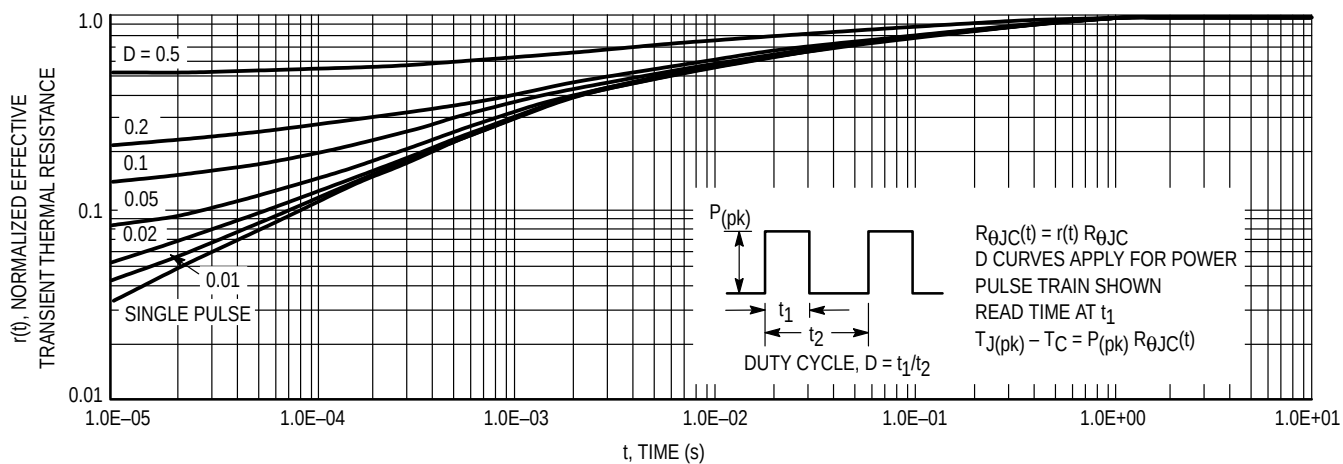
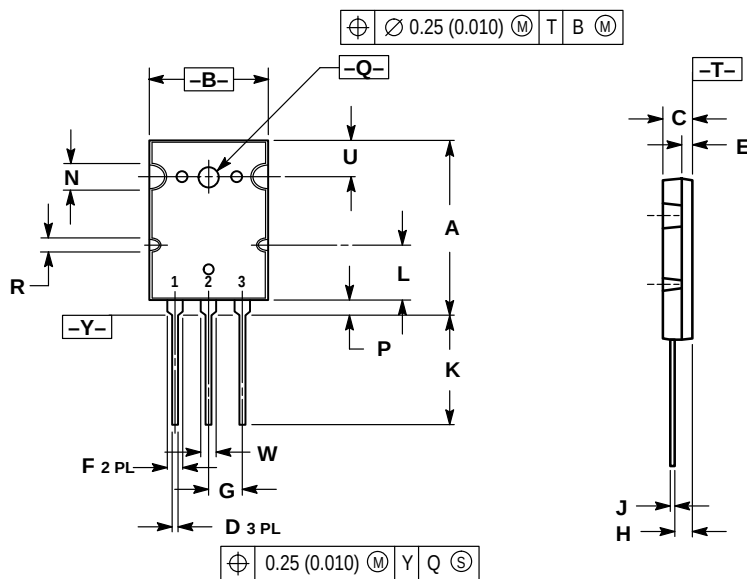


Figure 12. Thermal Response

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PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.8	2.9	1.102	1.142
B	19.3	20.3	0.760	0.800
C	4.7	5.3	0.185	0.209
D	0.93	1.48	0.037	0.058
E	1.9	2.1	0.075	0.083
F	2.2	2.4	0.087	0.102
G	5.45 BSC		0.215 BSC	
H	2.6	3.0	0.102	0.118
J	0.43	0.78	0.017	0.031
K	17.6	18.8	0.693	0.740
L	11.0	11.4	0.433	0.449
N	3.95	4.75	0.156	0.187
P	2.2	2.6	0.087	0.102
Q	3.1	3.5	0.122	0.137
R	2.15	2.35	0.085	0.093
U	6.1	6.5	0.240	0.256
W	2.8	3.2	0.110	0.125

- STYLE 5:
1. GATE
 2. COLLECTOR
 3. EMITTER

CASE 340G-02
TO-264
ISSUE E

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