

NGTB40N120LWG

IGBT

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop (FS) Trench construction, and provides superior performance in demanding switching applications. Offering both low on-state voltage and minimal switching loss, the IGBT is well suited for resonant or soft switching applications. Incorporated into the device is a rugged co-packaged free wheeling diode with a low forward voltage.

Features

- Low Saturation Voltage using Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Low Gate Charge
- 5 μ s Short-Circuit Capability
- These are Pb-Free Devices

Typical Applications

- Inverter Welding Machines
- Microwave Ovens
- Industrial Switching
- Motor Control Inverter

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	1200	V
Collector current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	I_C	80 40	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	320	A
Diode forward current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	I_F	80 40	A
Diode pulsed current, T_{pulse} limited by T_{Jmax}	I_{FM}	320	A
Gate-emitter voltage	V_{GE}	± 20	V
Power Dissipation @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	P_D	260 104	W
Short-Circuit Withstand Time $V_{GE} = 15\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J \leq 150^\circ\text{C}$	T_{sc}	5	μs
Operating junction temperature range	T_J	-55 to +150	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55 to +150	$^\circ\text{C}$
Lead temperature for soldering, 1/8" from case for 5 seconds	T_{SLD}	260	$^\circ\text{C}$

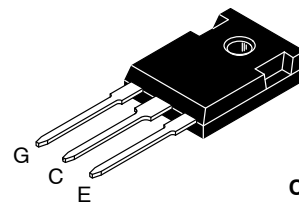
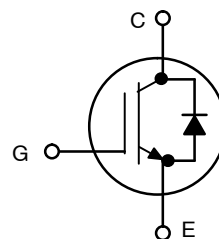
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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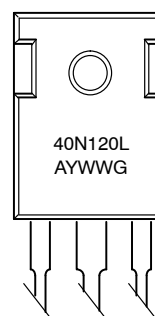
<http://onsemi.com>

40 A, 1200 V
 $V_{CEsat} = 1.90\text{ V}$
 $E_{off} = 1.40\text{ mJ}$



**TO-247
CASE 340L
STYLE 4**

MARKING DIAGRAM



A = Assembly Location
 Y = Year
 WW = Work Week
 G = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping
NGTB40N120LWG	TO-247 (Pb-Free)	30 Units / Rail

NGTB40N120LWG

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.48	°C/W
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	1.5	°C/W
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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STATIC CHARACTERISTIC

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, I_C = 500\ \mu\text{A}$	$V_{(BR)CES}$	1200	-	-	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 25\text{ A}, T_J = 150^\circ\text{C}$	V_{CEsat}	1.45 -	1.90 2.1	2.35 -	V
Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 400\ \mu\text{A}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$ $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 150^\circ\text{C}$	I_{CES}	-	-	0.5 2.0	mA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	I_{GES}	-	-	200	nA

DYNAMIC CHARACTERISTIC

Input capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{ies}	-	10,400	-	pF
Output capacitance		C_{oes}	-	245	-	
Reverse transfer capacitance		C_{res}	-	185	-	
Gate charge total	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	Q_g	-	420	-	nC
Gate to emitter charge		Q_{ge}	-	95	-	
Gate to collector charge		Q_{gc}	-	178	-	

SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-on delay time	$T_J = 25^\circ\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	-	140	-	ns
Rise time		t_r	-	40	-	
Turn-off delay time		$t_{d(off)}$	-	360	-	
Fall time		t_f	-	132	-	mJ
Turn-on switching loss		E_{on}	-	5.5	-	
Turn-off switching loss		E_{off}	-	1.40	-	
Turn-on delay time	$T_J = 125^\circ\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	-	134	-	ns
Rise time		t_r	-	44	-	
Turn-off delay time		$t_{d(off)}$	-	380	-	
Fall time		t_f	-	185	-	mJ
Turn-on switching loss		E_{on}	-	6.8	-	
Turn-off switching loss		E_{off}	-	2.6	-	

DIODE CHARACTERISTIC

Forward voltage	$V_{GE} = 0\text{ V}, I_F = 40\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 40\text{ A}, T_J = 150^\circ\text{C}$	V_F	-	1.6 1.8	1.8 -	V
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NGTB40N120LWG

TYPICAL CHARACTERISTICS

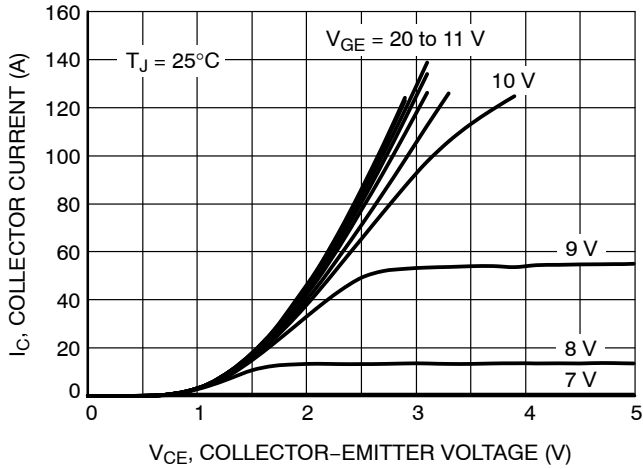


Figure 1. Output Characteristics

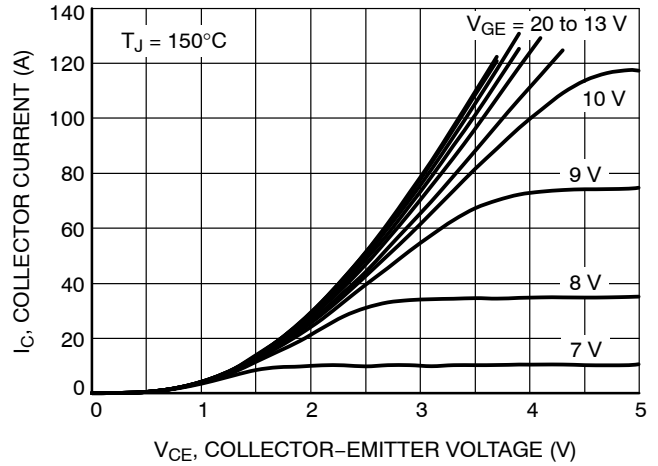


Figure 2. Output Characteristics

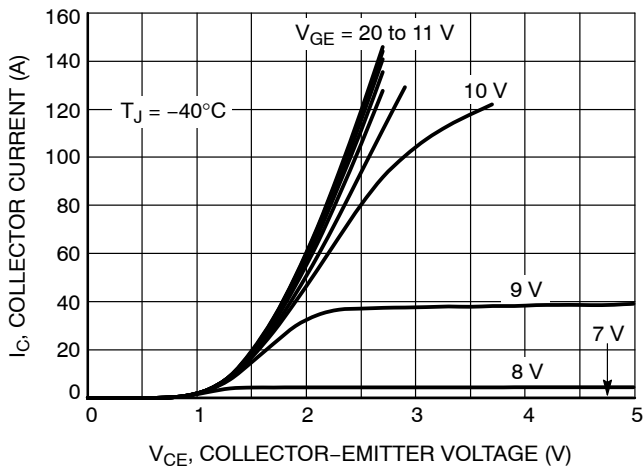


Figure 3. Output Characteristics

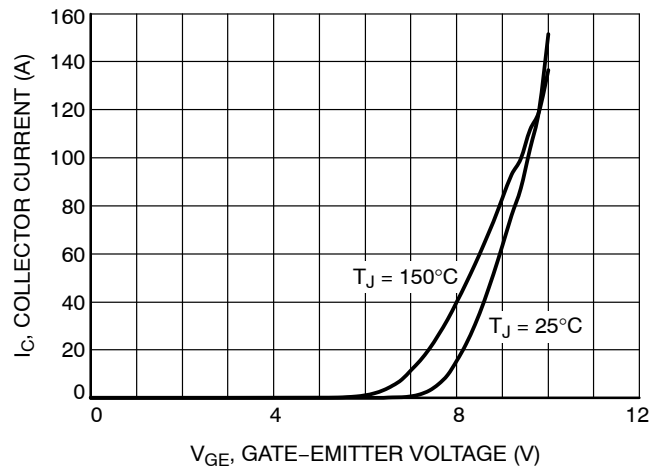


Figure 4. Typical Transfer Characteristics

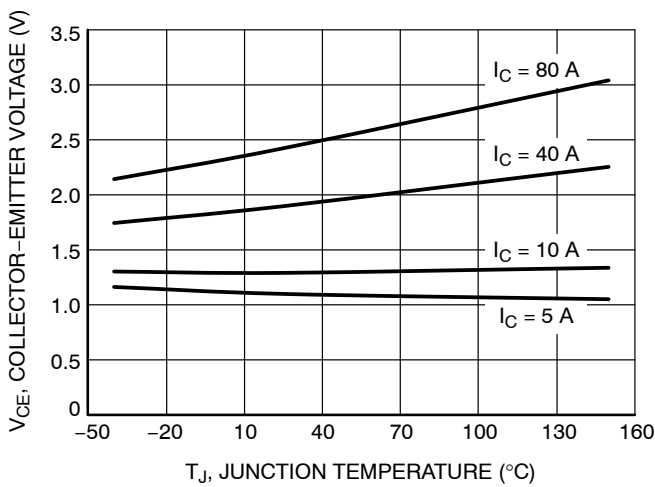


Figure 5. $V_{CE(sat)}$ vs. T_J

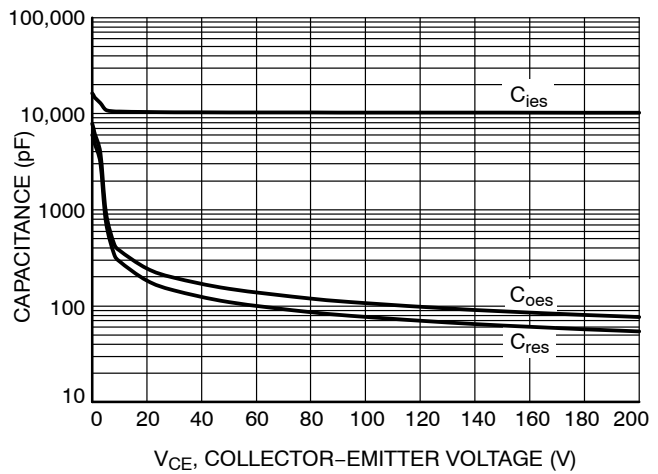


Figure 6. Typical Capacitance

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TYPICAL CHARACTERISTICS

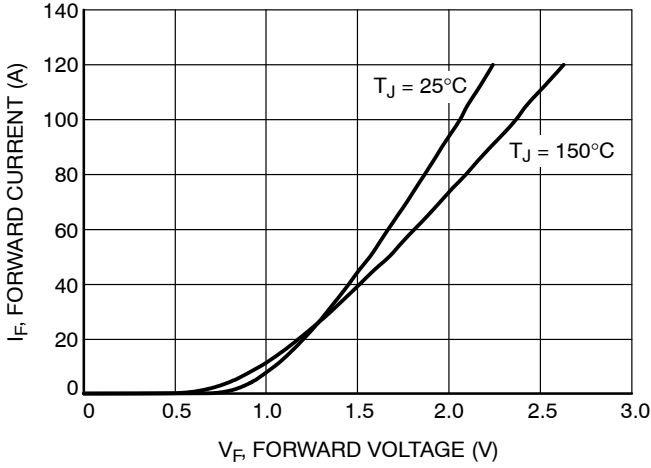


Figure 7. Diode Forward Characteristics

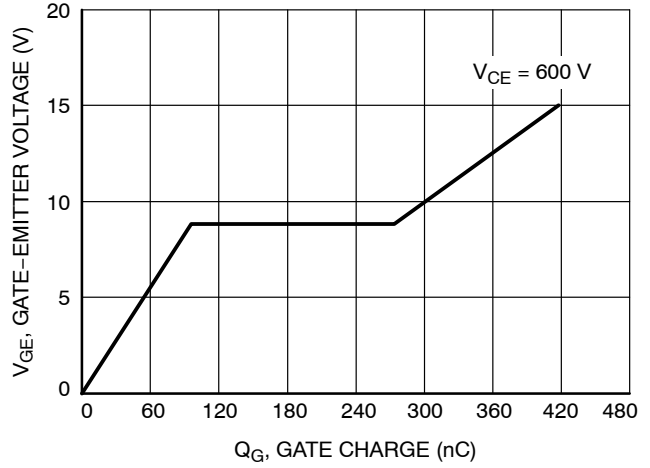


Figure 8. Typical Gate Charge

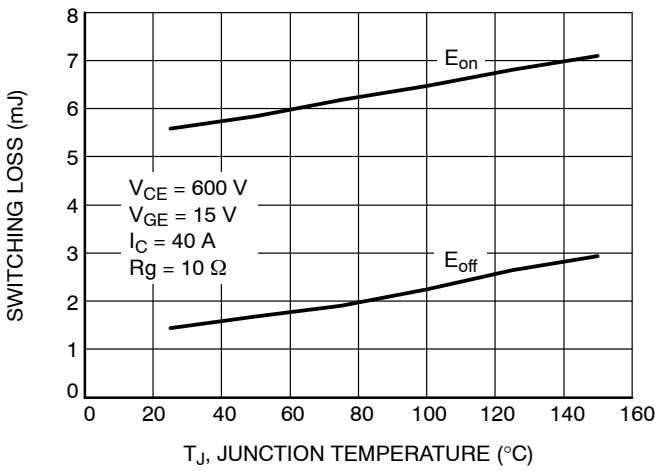


Figure 9. Switching Loss vs. Temperature

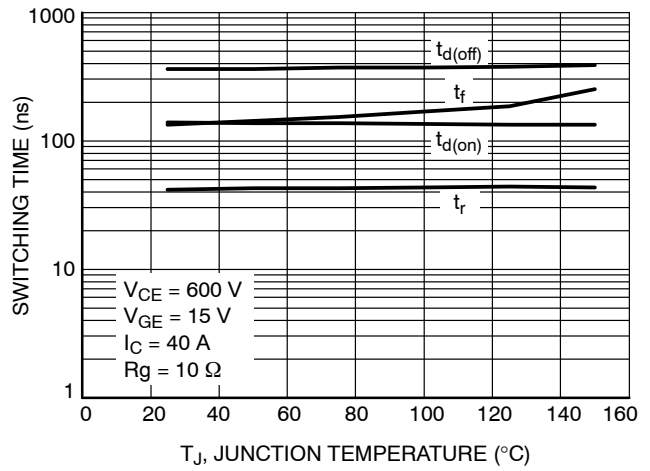


Figure 10. Switching Time vs. Temperature

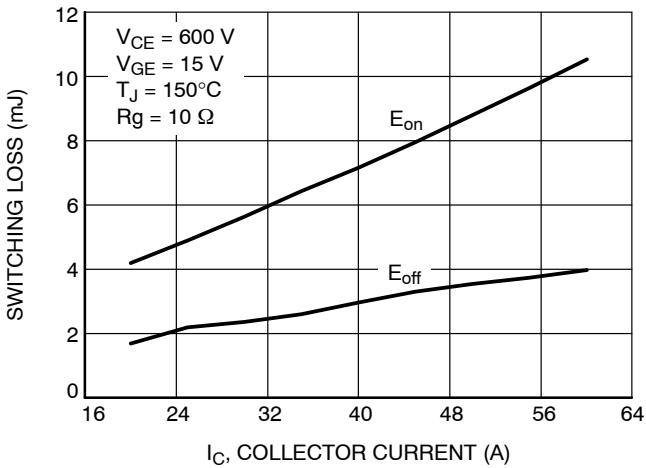


Figure 11. Switching Loss vs. I_C

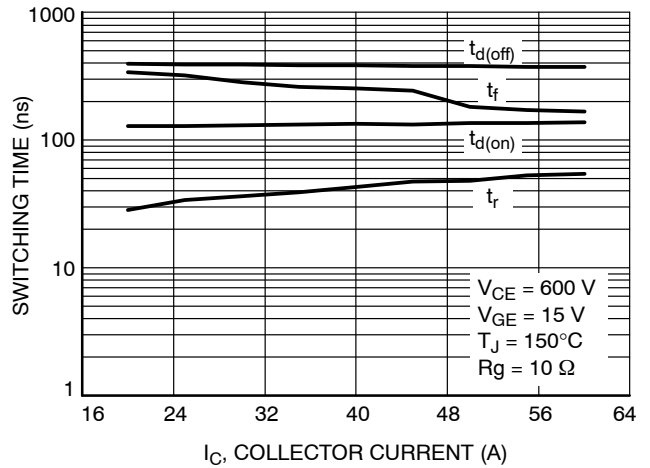


Figure 12. Switching Time vs. I_C

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TYPICAL CHARACTERISTICS

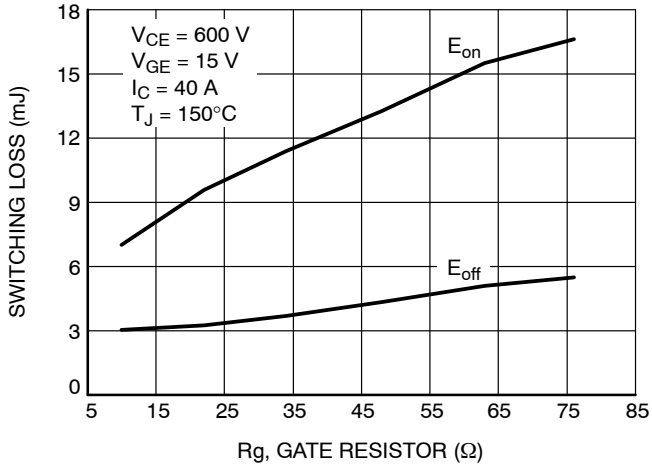


Figure 13. Switching Loss vs. Rg

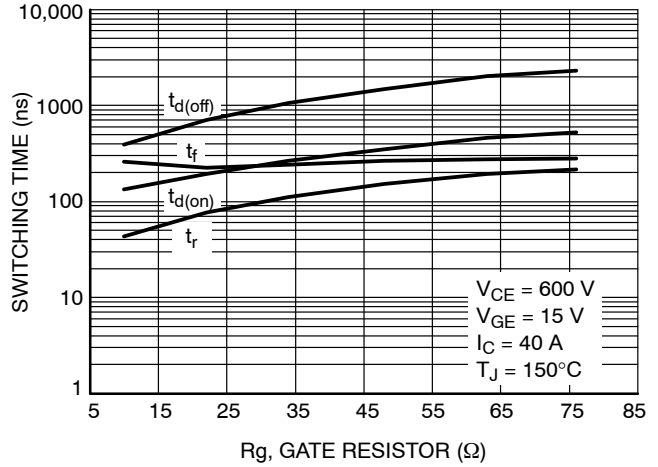


Figure 14. Switching Time vs. Rg

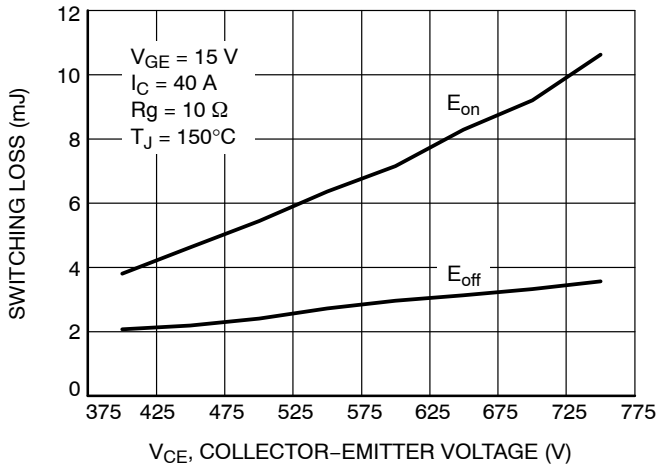


Figure 15. Switching Loss vs. V_{CE}

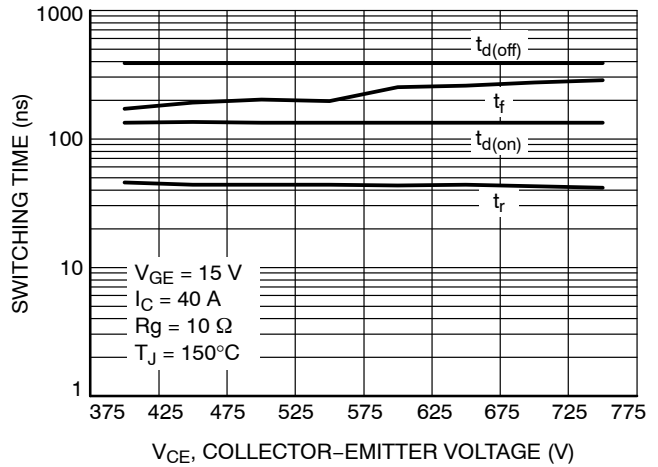


Figure 16. Switching Time vs. V_{CE}

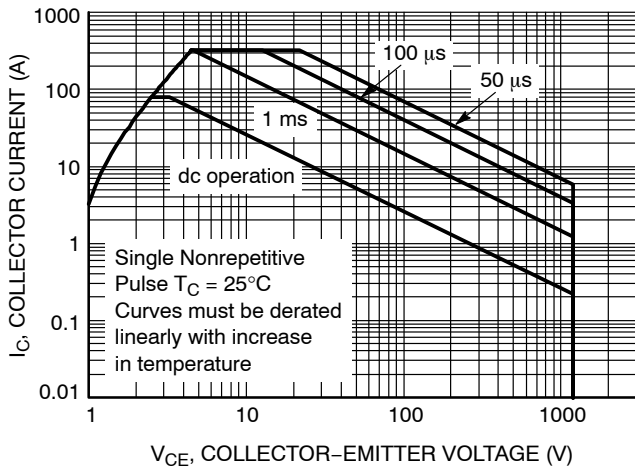


Figure 17. Safe Operating Area

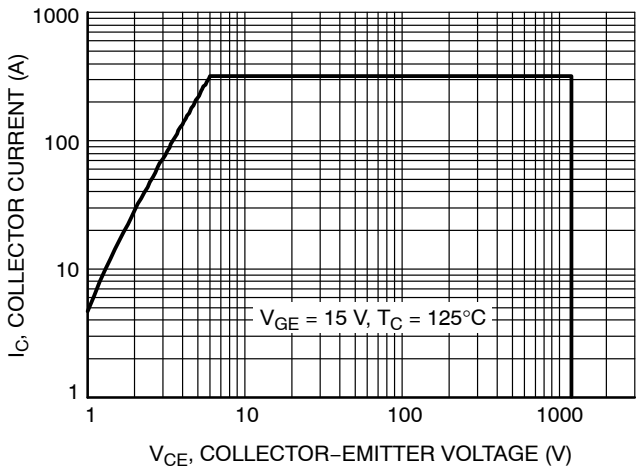


Figure 18. Reverse Bias Safe Operating Area

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TYPICAL CHARACTERISTICS

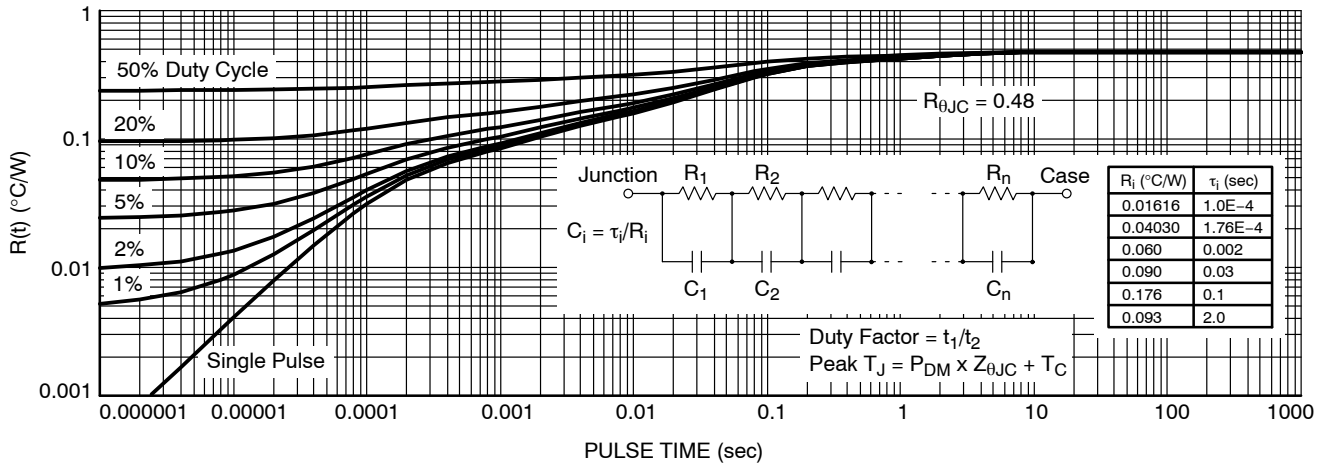


Figure 19. IGBT Transient Thermal Impedance

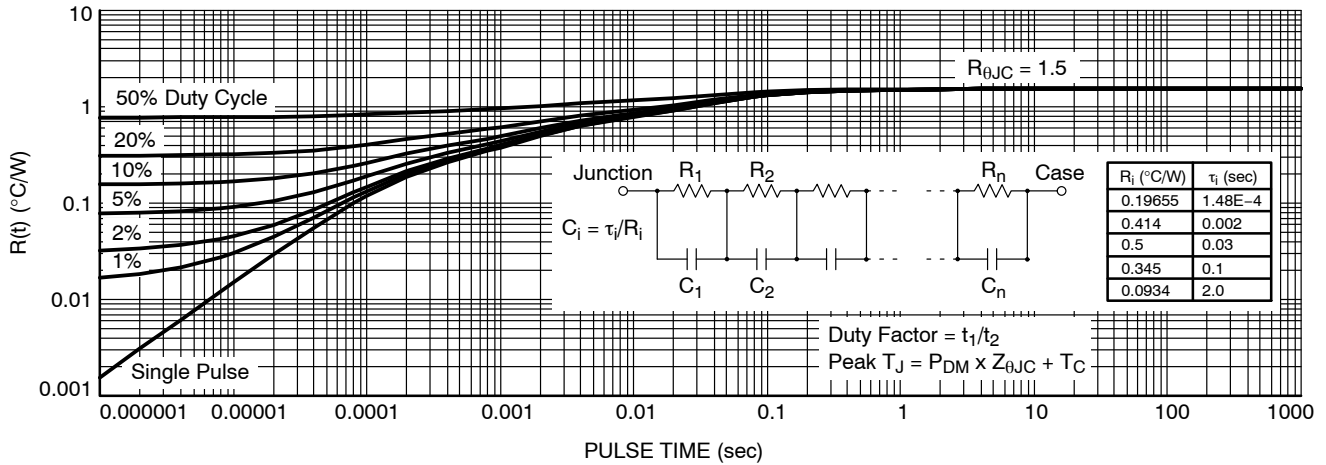


Figure 20. Diode Transient Thermal Impedance

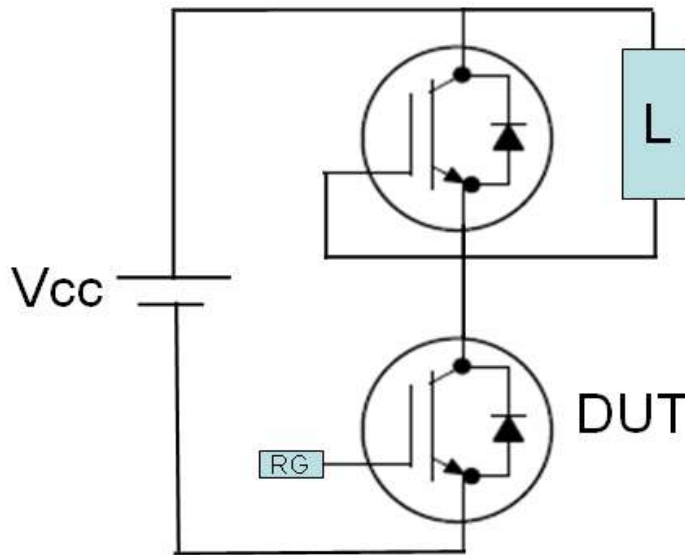


Figure 21. Test Circuit for Switching Characteristics

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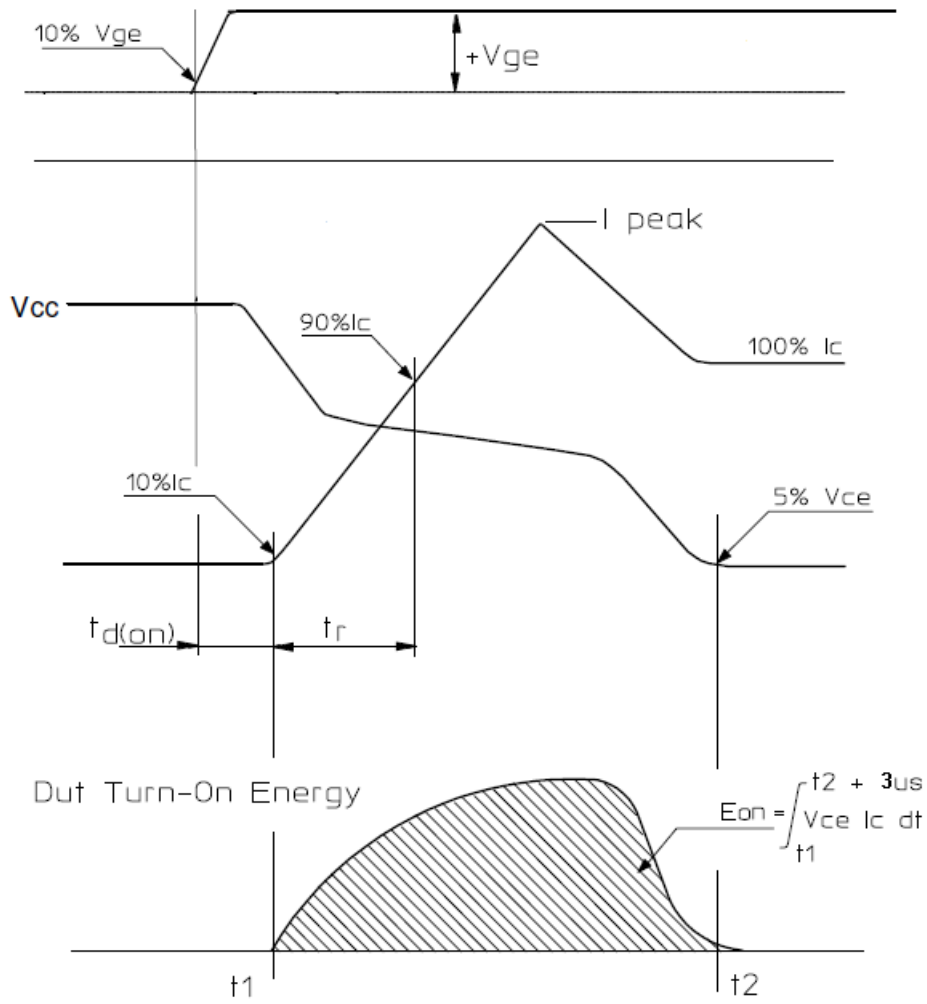


Figure 22. Definition of Turn On Waveform

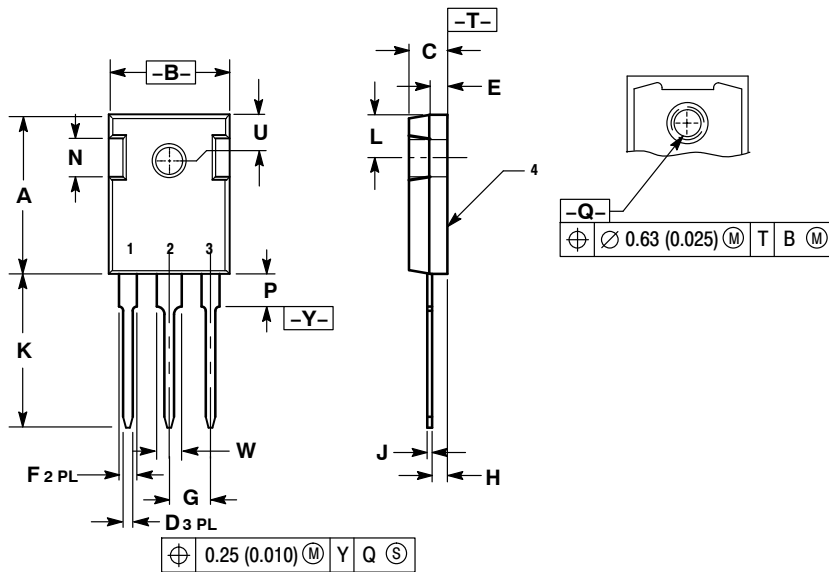


Figure 23. Definition of Turn Off Waveform

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PACKAGE DIMENSIONS

TO-247
CASE 340L-02
ISSUE F



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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	1.90	2.60	0.075	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	19.81	20.83	0.780	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

- STYLE 4:
1. GATE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

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