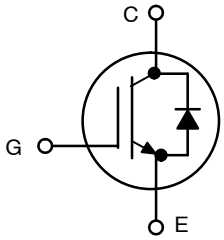
IGBT – Field Stop II

NGTB40N120FL2WG

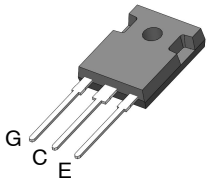
40 A, 1200 V
V_{CEsat} = 2.0 V
E_{off} = 1.1 mJ

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop II 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 UPS and solar applications. Incorporated into the device is a soft and fast co-packaged free wheeling diode with a low forward voltage.



Features

- Extremely Efficient Trench with Field Stop Technology
- T_{Jmax} = 175 °C
- Soft Fast Reverse Recovery Diode
- Optimized for High Speed Switching
- 10 µs Short Circuit Capability
- These are Pb-Free Devices

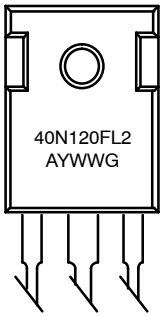


TO-247
CASE 340AM

Typical Applications

- Solar Inverter
- Uninterruptible Power Inverter Supplies (UPS)
- Welding

MARKING DIAGRAM



40N120FL2 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

ABSOLUTE MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V_{CES}	Collector-emitter Voltage	1200	V
I_C	Collector Current @ T_C = 25 °C @ T_C = 100 °C	 80 40	A
I_{CM}	Pulsed Collector Current, T_{pulse} Limited by T_{Jmax}	200	A
I_F	Diode Forward Current @ T_C = 25°C @ T_C = 100 °C	 80 40	A
I_{FM}	Diode Pulsed Current, T_{pulse} Limited by T_{Jmax}	200	A
V_{GE}	Gate-emitter Voltage Transient Gate-emitter Voltage (T_{pulse} = 5 µs, D < 0.10)	±20 ±30	V
P_D	Power Dissipation @ T_C = 25 °C @ T_C = 100 °C	 535 267	W
T_{SC}	Short Circuit Withstand Time V_{GE} = 15 V, V_{CE} = 500 V, T_J ≤ 150 °C	10	µs
T_J	Operating Junction Temperature Range	−55 to +175	°C
T_{stg}	Storage Temperature Range	−55 to +175	°C
T_{SLD}	Lead temperature for soldering, 1/8″ from case for 5 seconds	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ORDERING INFORMATION

Device	Package	Shipping
NGTB40N120FL2WG	TO-247 (Pb-Free)	30 Units / Rail

THERMAL CHARACTERISTICS

Symbol	Rating	Value	Unit
$R_{\theta JC}$	Thermal resistance junction-to-case, for IGBT	0.28	°C/W
$R_{\theta JC}$	Thermal resistance junction-to-case, for Diode	0.5	°C/W
$R_{\theta JA}$	Thermal resistance junction-to-ambient	40	°C/W

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
STATIC CHARACTERISTIC						
$V_{(BR)CES}$	Collector-emitter breakdown voltage, gate-emitter short-circuited	V_{GE} = 0 V, I_C = 500 μA	1200			V
V_{CEsat}	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 40 A V_{GE} = 15 V, I_C = 40 A, T_J = 175 °C		2.00 2.40	2.40	V
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE} = V_{CE}, I_C = 400 μA	4.5	5.5	6.5	V
I_{CES}	Collector-emitter cut-off current, gate-emitter short-circuited	V_{GE} = 0 V, V_{CE} = 1200 V V_{GE} = 0 V, V_{CE} = 1200 V, $T_{J\ =}$ 175 °C		 2	0.1	mA
I_{GES}	Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V , V_{CE} = 0 V			200	nA
DYNAMIC CHARACTERISTIC						
C_{ies}	Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz		7385		pF
C_{oes}	Output capacitance			230		
C_{res}	Reverse transfer capacitance			140		
Q_g	Gate charge total	V_{CE} = 600 V, I_C = 40 A, V_{GE} = 15 V		313		nC
Q_{ge}	Gate to emitter charge			61		
Q_{gc}	Gate to collector charge			151		
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
$t_{d(on)}$	Turn−on delay time	T_J = 25 °C V_{CC} = 600 V, I_C = 40 A R_g = 10 Ω V_{GE} = 0 V/ 15V		116		ns
t_r	Rise time			42		
$t_{d(off)}$	Turn−off delay time			286		
t_f	Fall time			121		
E_{on}	Turn−on switching loss			3.4		mJ
E_{off}	Turn−off switching loss			1.1		
E_{ts}	Total switching loss			4.5		
$t_{d(on)}$	Turn−on delay time	T_J = 175 °C V_{CC} = 600 V, I_C = 40 A R_g = 10 Ω V_{GE} = 0 V/ 15 V		111		ns
t_r	Rise time			43		
$t_{d(off)}$	Turn−off delay time			304		
t_f	Fall time			260		
E_{on}	Turn−on switching loss			4.4		mJ
E_{off}	Turn−off switching loss			2.5		
E_{ts}	Total switching loss			6.9		
DIODE CHARACTERISTIC						
V_F	Forward voltage	V_{GE} = 0 V, I_F = 40 A V_{GE} = 0 V, I_F = 50 A, T_J = 175 °C		2.00 2.30	2.6	V
t_{rr}	Reverse recovery time	T_J = 25 °C I_F = 40 A, V_R = 400 V di_F/dt = 200 A/μs		240		ns
Q_{rr}	Reverse recovery charge			2.5		μc
I_{rrm}	Reverse recovery current			18		A
t_{rr}	Reverse recovery time	T_J = 175 °C I_F = 40 A, V_R = 400 V di_F/dt = 200 A/μs		392		ns
Q_{rr}	Reverse recovery charge			5.36		μc
I_{rrm}	Reverse recovery current			25.80		A

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

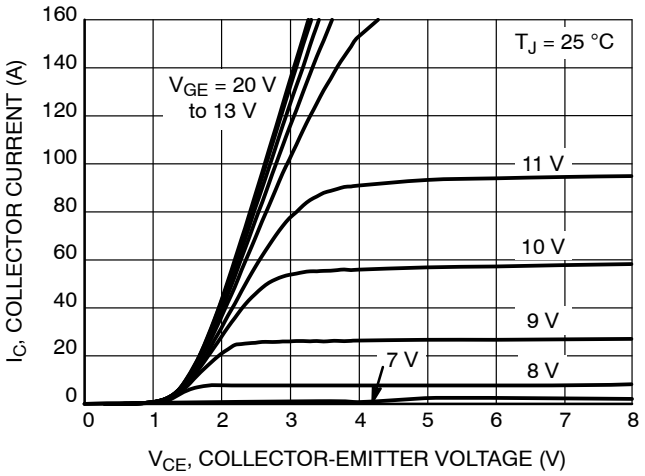


Figure 1. Output Characteristics

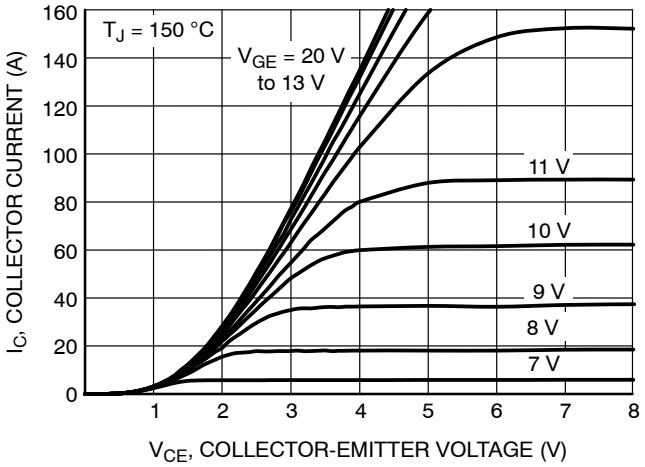


Figure 2. Output Characteristics

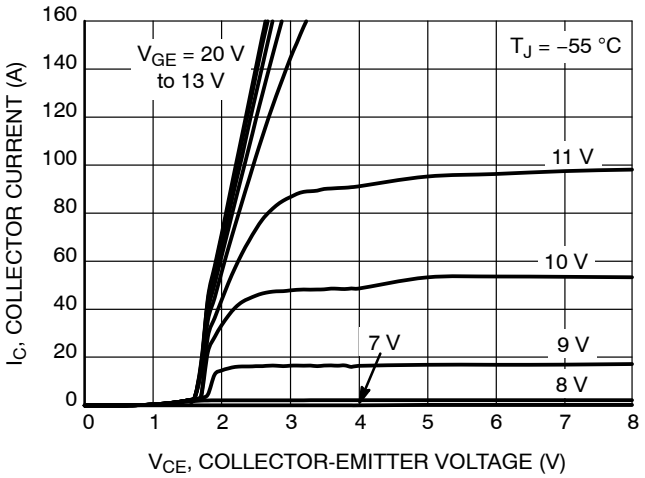


Figure 3. Output Characteristics

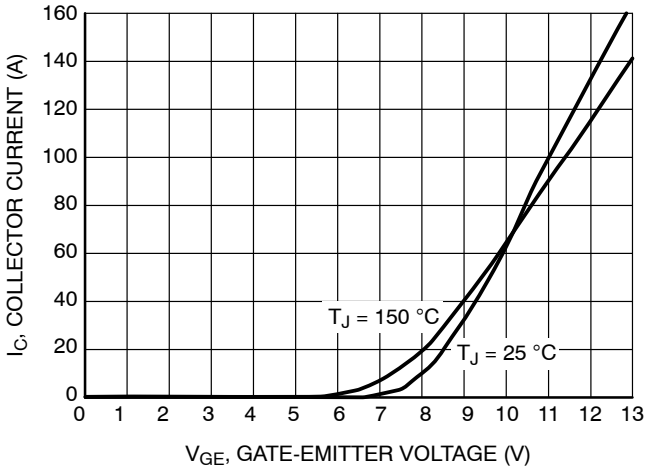


Figure 4. Typical Transfer Characteristics

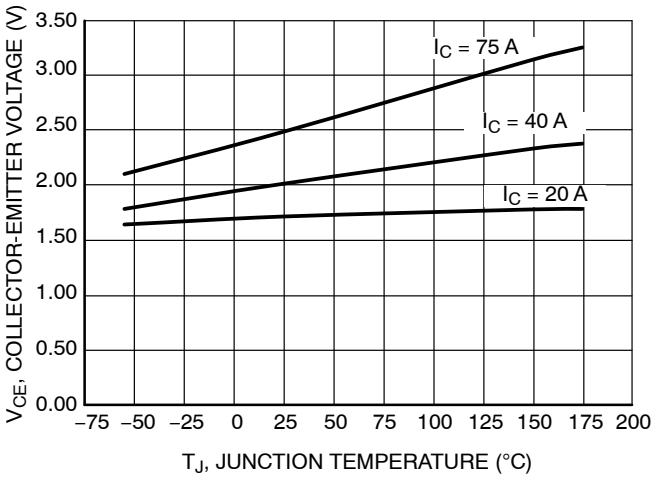


Figure 5. $V_{CE(sat)}$ vs T_J

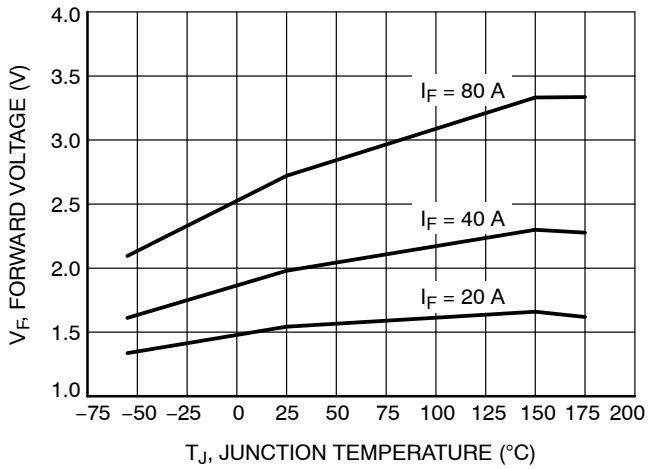


Figure 6. V_F vs. T_J

TYPICAL CHARACTERISTICS (continued)

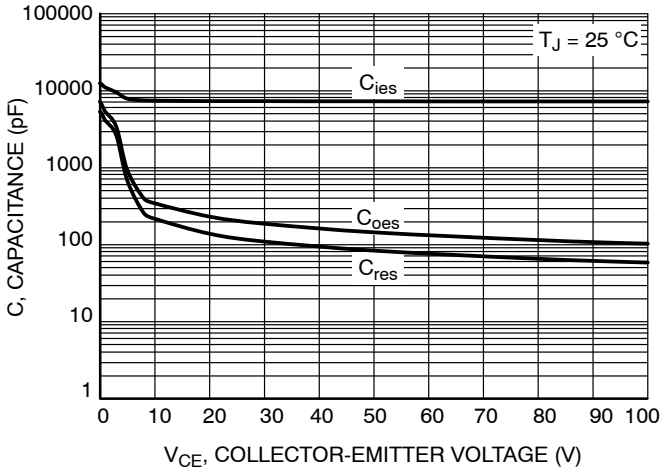


Figure 7. Typical Capacitance

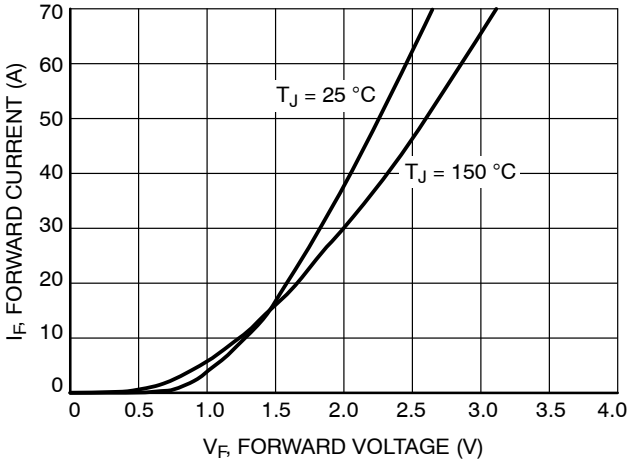


Figure 8. Diode Forward Characteristics

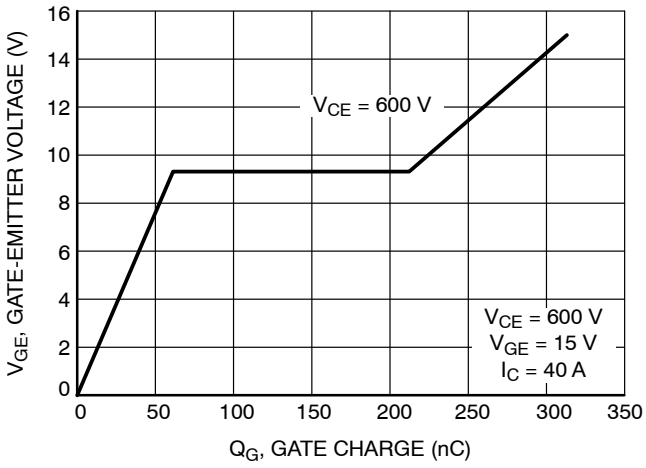


Figure 9. Typical Gate Charge

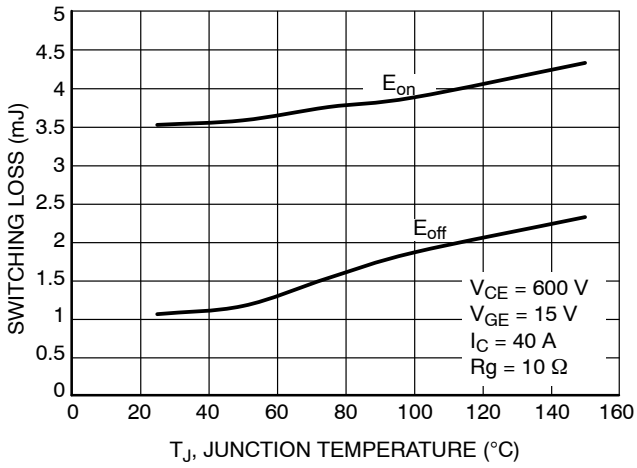


Figure 10. Switching Loss vs. Temperature

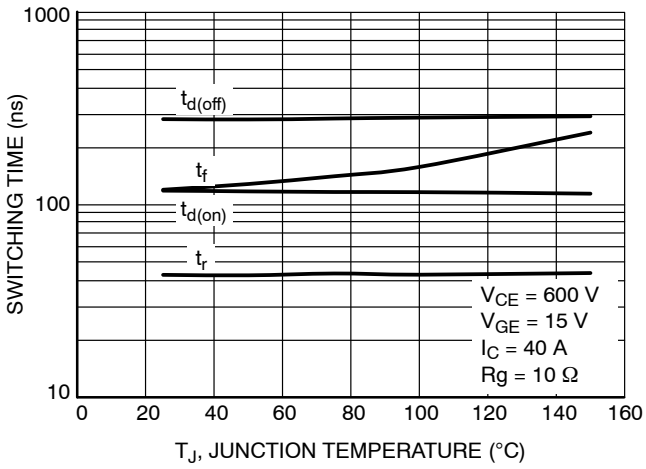


Figure 11. Switching Time vs. Temperature

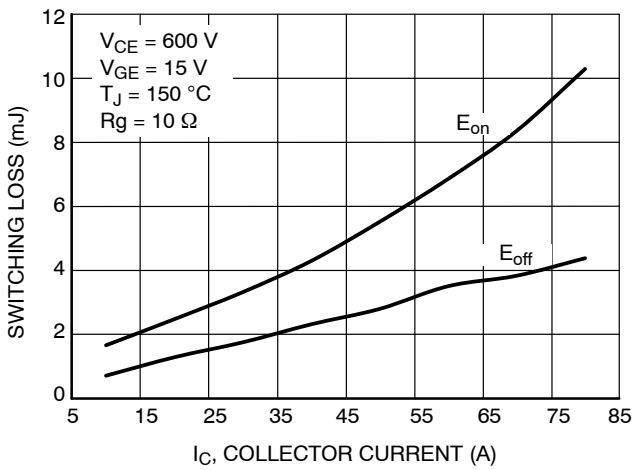


Figure 12. Switching Loss vs. I_C

TYPICAL CHARACTERISTICS (continued)

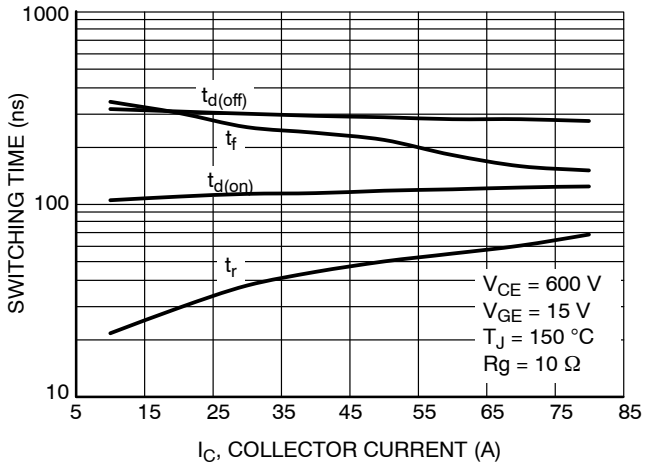


Figure 13. Switching Time vs. I_C

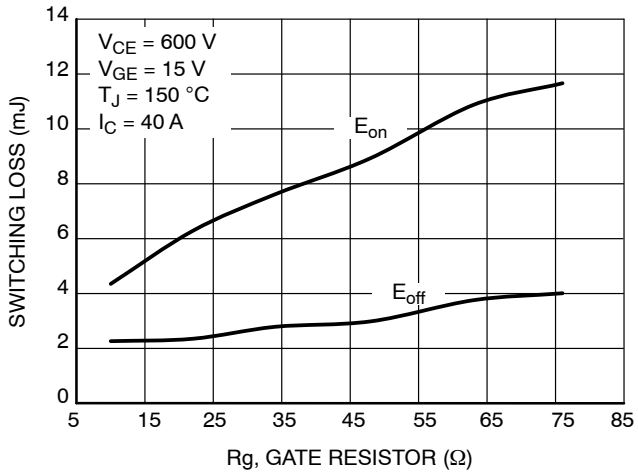


Figure 14. Switching Loss vs. Rg

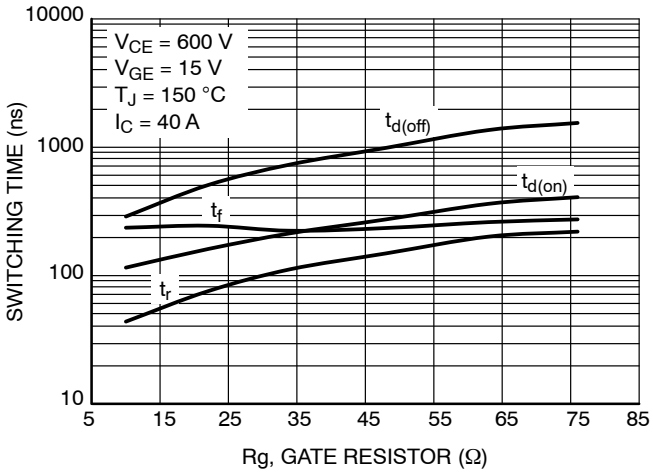


Figure 15. Switching Time vs. Rg

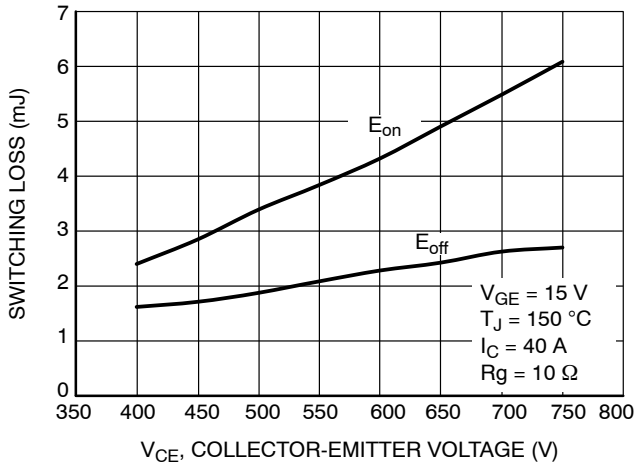


Figure 16. Switching Loss vs. V_{CE}

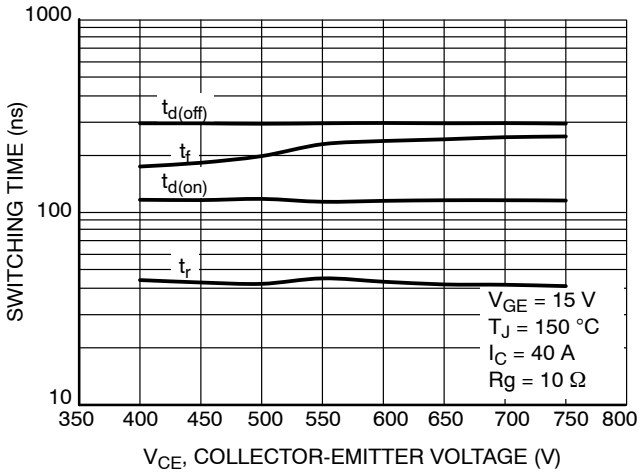


Figure 17. Switching Time vs. V_{CE}

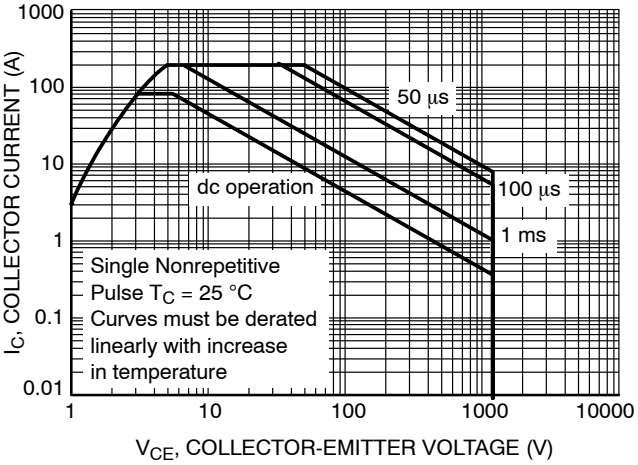


Figure 18. Safe Operating Area

TYPICAL CHARACTERISTICS (continued)

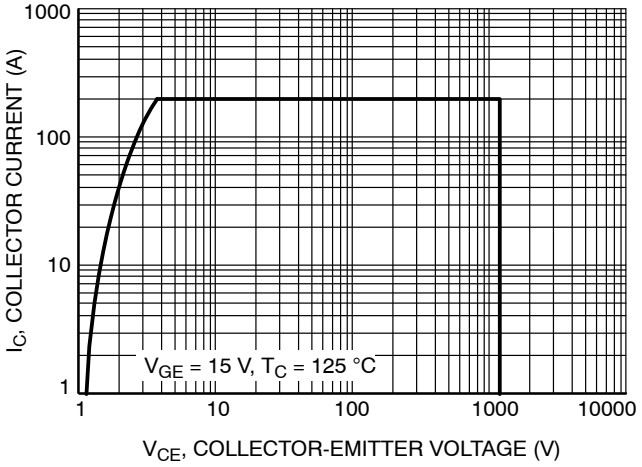


Figure 19. Reverse Bias Safe Operating Area

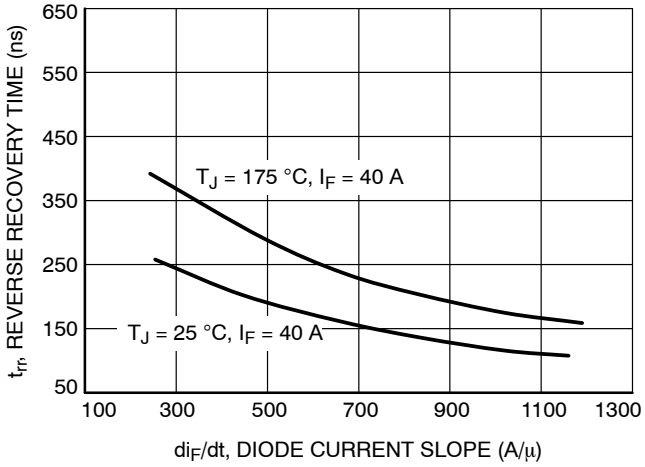


Figure 20. t_{rr} vs. di_F/dt (V_R = 400 V)

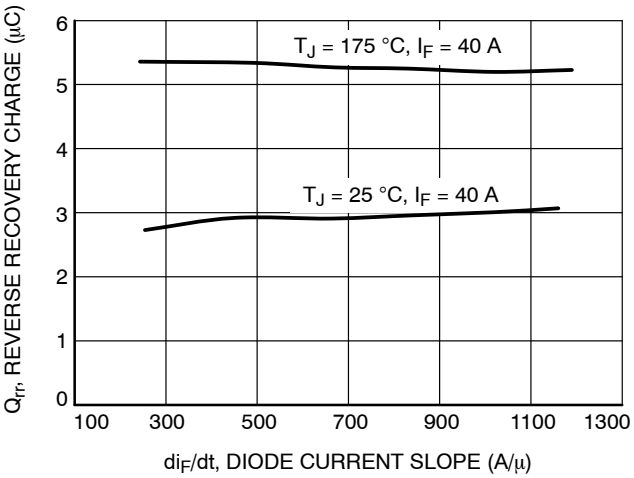


Figure 21. Q_{rr} vs. di_F/dt (V_R = 400 V)

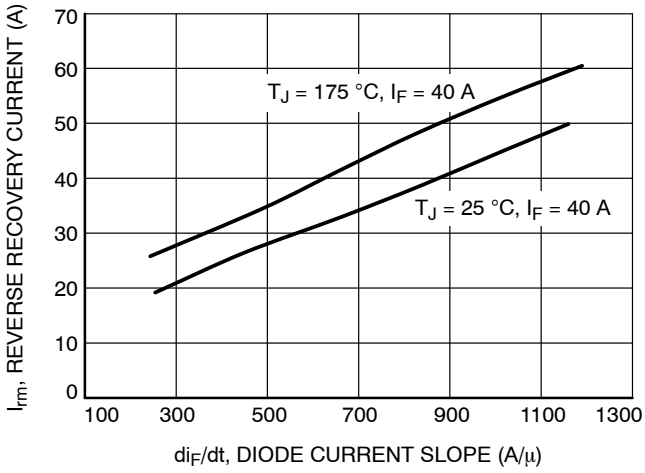


Figure 22. I_{rm} vs. di_F/dt (V_R = 400 V)

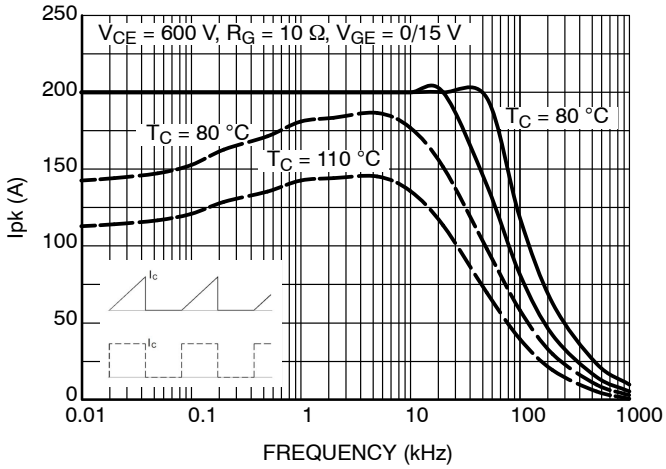
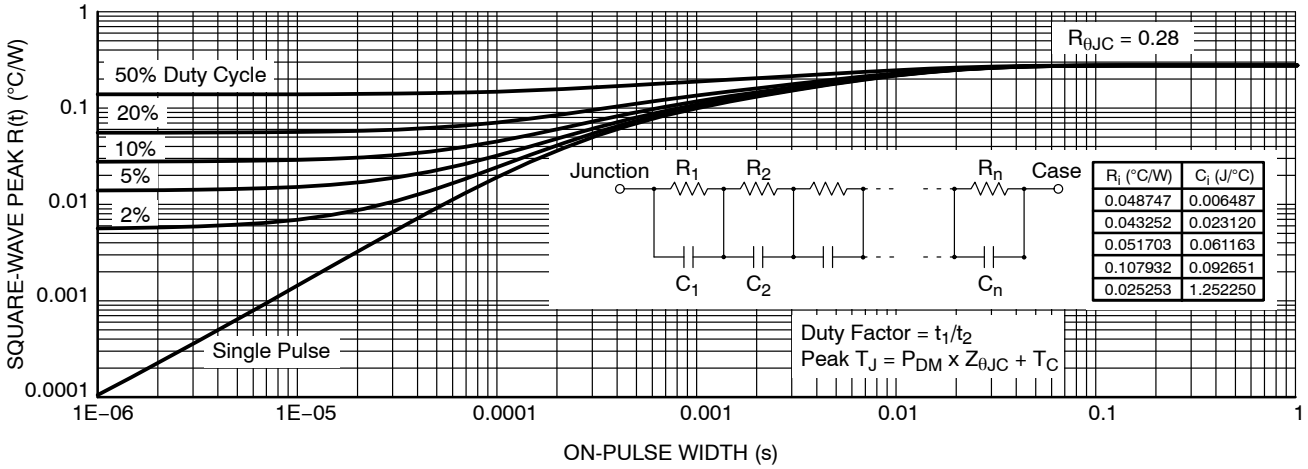


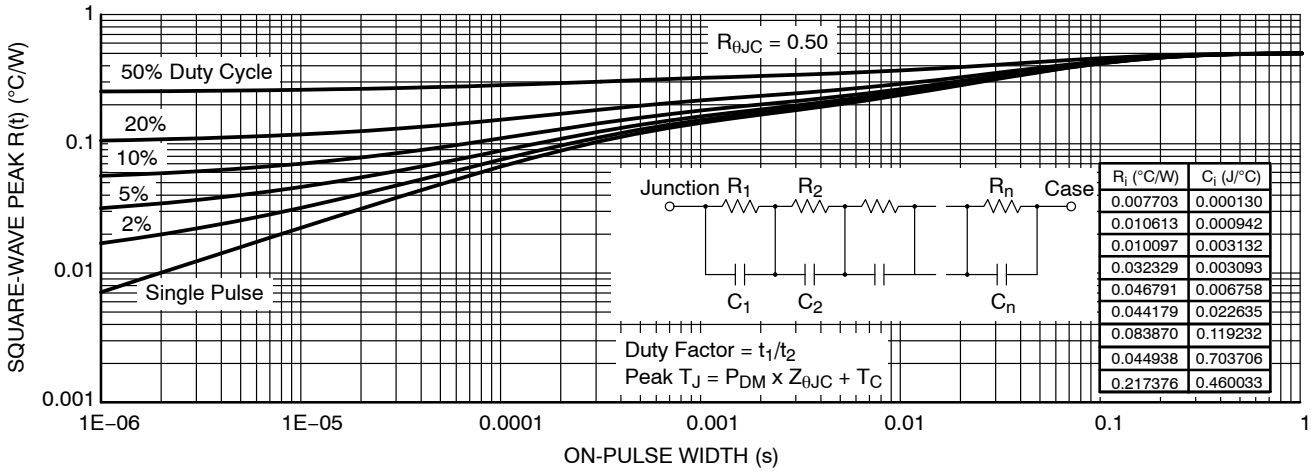
Figure 23. Collector Current vs. Switching Frequency

TYPICAL CHARACTERISTICS (continued)



R_i (°C/W)	C_i (J/°C)
0.048747	0.006487
0.043252	0.023120
0.051703	0.061163
0.107932	0.092651
0.025253	1.252250

Figure 24. IGBT Transient Thermal Impedance



R_i (°C/W)	C_i (J/°C)
0.007703	0.000130
0.010613	0.000942
0.010097	0.003132
0.032329	0.003093
0.046791	0.006758
0.044179	0.022635
0.083870	0.119232
0.044938	0.703706
0.217376	0.460033

Figure 25. Diode Transient Thermal Impedance

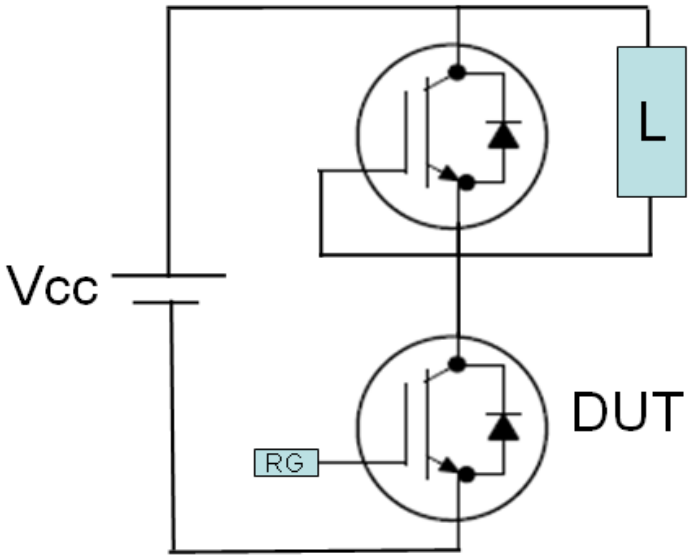


Figure 26. Test Circuit for Switching Characteristics

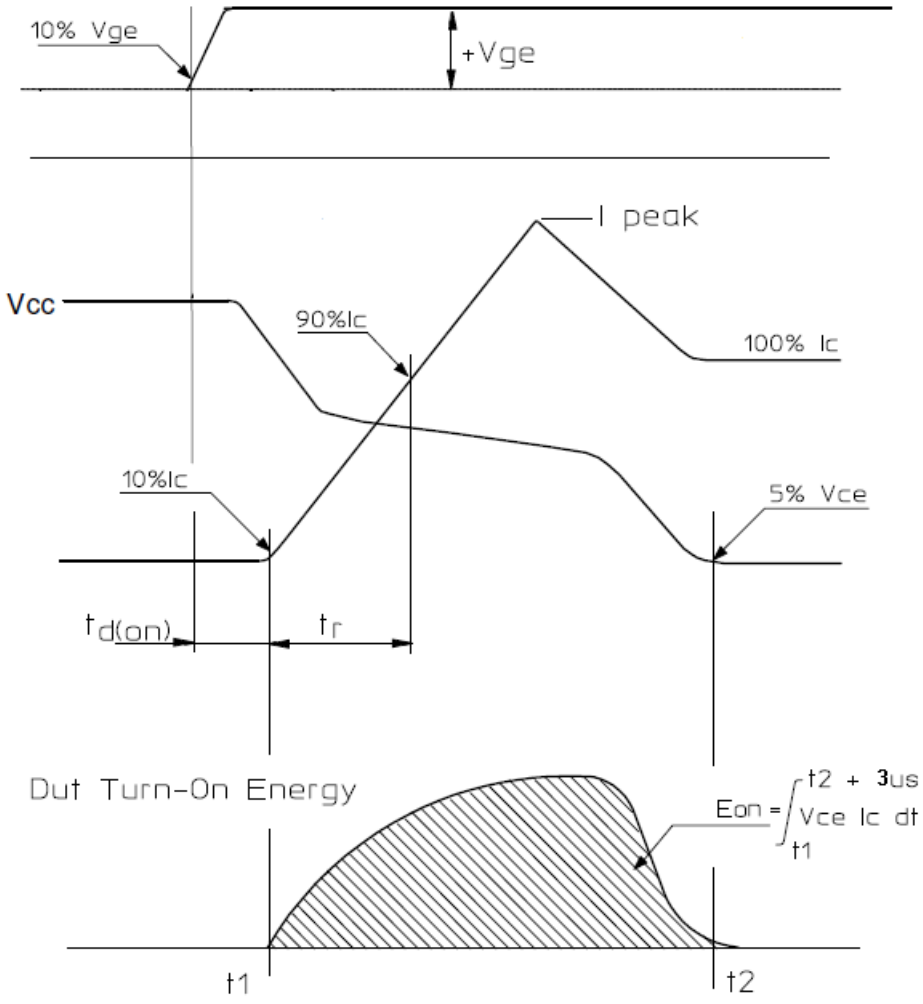


Figure 27. Definition of Turn On Waveform

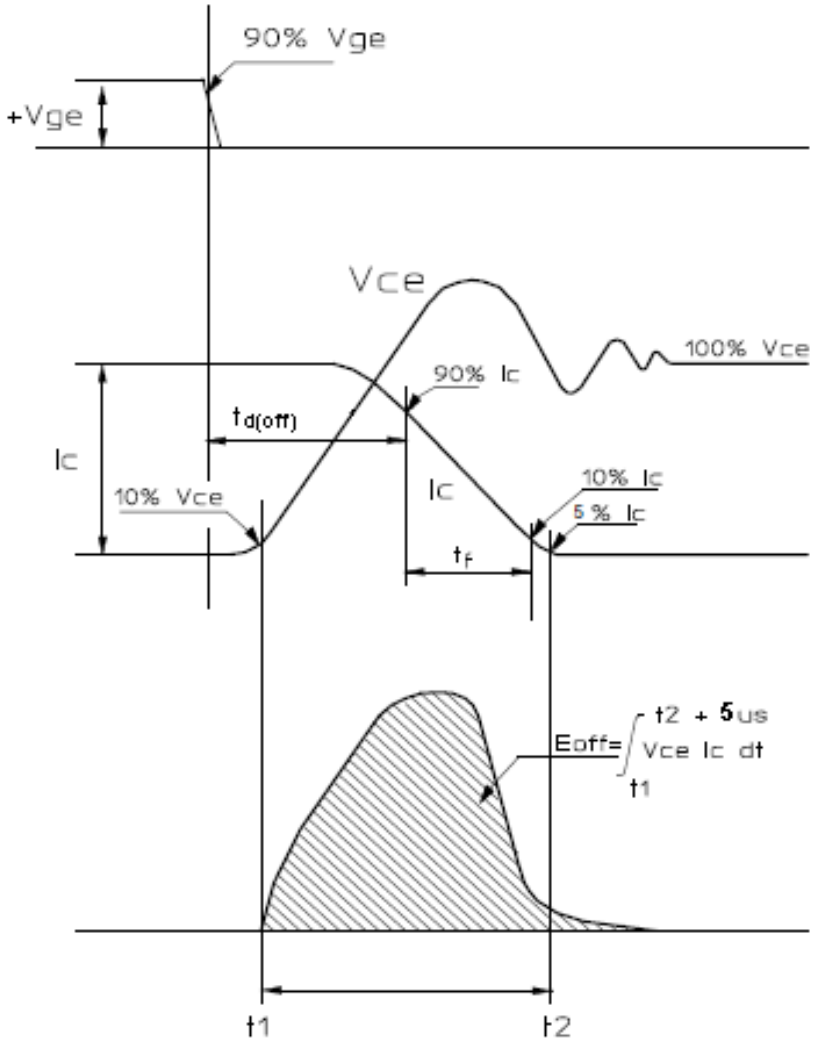
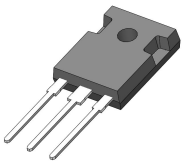


Figure 28. Definition of Turn Off Waveform

REVISION HISTORY

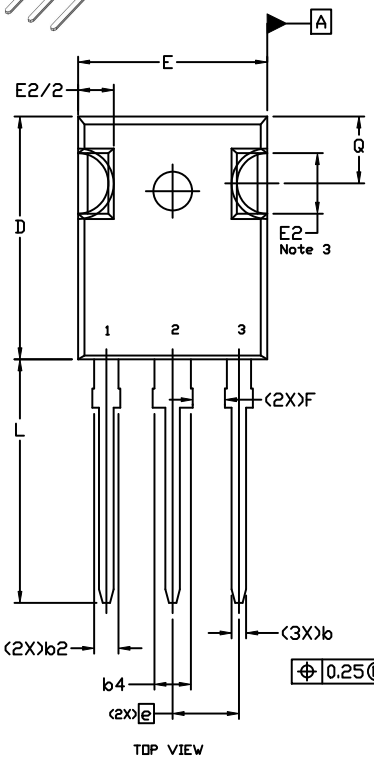
Revision	Description of Changes	Date
9	Update the data sheet to move value from Max to Typ under ICES symbol.	3/23/2026
10	Revision to to correct the VF Max from 2.0 V to 2.6 V.	6/2/2026

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

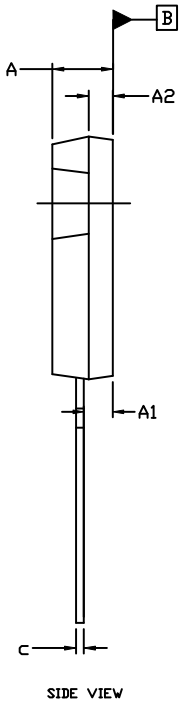


TO−247
CASE 340AM
ISSUE C

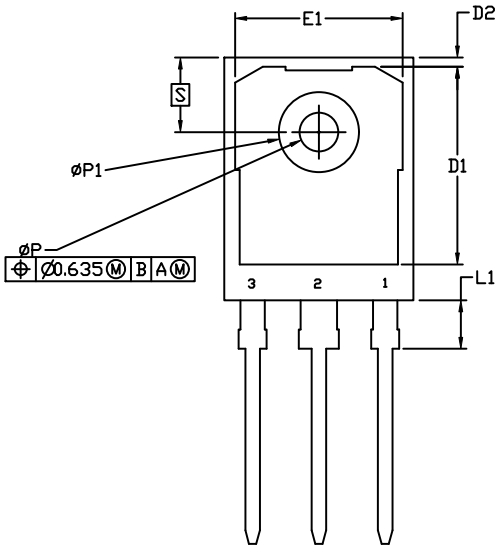
DATE 07 SEP 2021



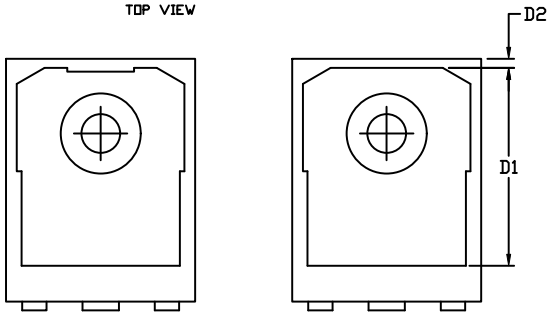
TOP VIEW



SIDE VIEW



BACK VIEW



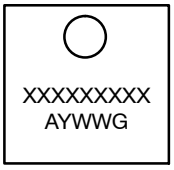
NOTE 4 HEATSINK SHAPES

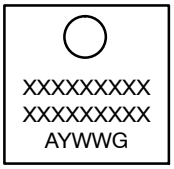
NOTES:

1. DIMENSIONING AND TOLERANCE AS PER ASME Y14.5M, 2009.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. SLOT REQUIRED, NOTCH MAY BE ROUNDED.
4. OPTIONAL BACK SIDE HEATSINK SHAPE.
5. DIMENSIONS ARE EXCLUSIVE OF BURRS AND MOLD FLASH. DIMENSIONS D AND E ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
6. DIMENSIONS A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
7. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.70	5.00	5.30
A1	2.20	2.40	2.60
A2	1.80	2.00	2.20
b	1.07	1.20	1.33
b2	1.65	2.12	2.35
b4	2.60	3.12	3.40
c	0.45	0.60	0.75
D	20.80	21.00	21.34
D1	16.30	---	---
D2	0.75	---	---
E	15.50	16.00	16.25
E1	13.80	---	---
E2	4.32	4.90	5.49
e	5.45 BSC		
F	2.655	---	---
L	19.80	20.00	20.80
L1	3.81	4.20	4.35
P	3.55	3.60	3.65
P1	6.60	---	---
Q	5.40	6.00	6.20
S	6.15 BSC		

GENERIC MARKING DIAGRAMS*





XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

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