

# TMPIM 35 A CIB/CI Module

## Product Preview

### NXH35C120L2C2SG/S1G

The NXH35C120L2C2SG is a transfer-molded power module containing a converter-inverter-brake circuit consisting of six 35 A, 1600 V rectifiers, six 35 A, 1200 V IGBTs with inverse diodes, one 35 A, 1200 V brake IGBT with brake diode and an NTC thermistor.

The NXH35C120L2C2S1G is a transfer-molded power module containing a converter-inverter circuit consisting of six 35 A, 1600 V rectifiers, six 35 A, 1200 V IGBTs with inverse diodes, and an NTC thermistor.

#### Features

- Low Thermal Resistance
- 6 mm Clearance Distance from Pin to Heatsink
- Compact 73 mm × 40 mm × 8 mm Package
- Solderable Pins
- Thermistor
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Typical Applications

- Industrial Motor Drives
- Servo Drives

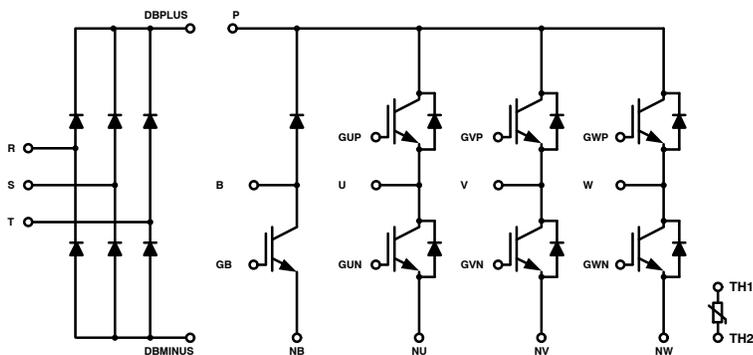


Figure 1. NXH35C120L2C2SG Schematic Diagram

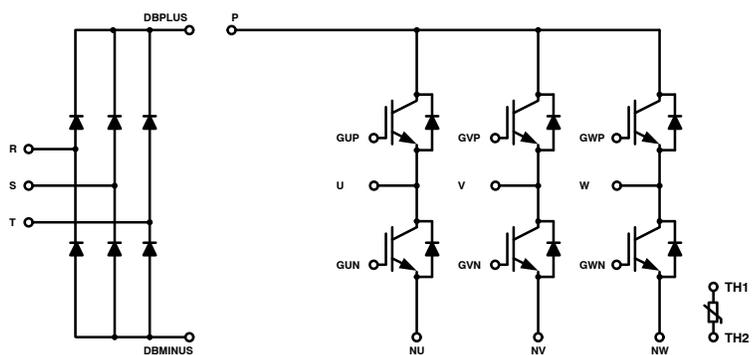
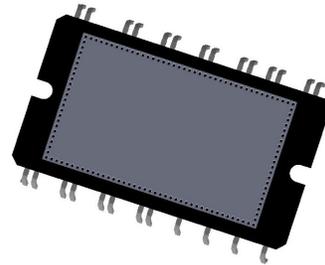


Figure 2. NXH35C120L2C2S1G Schematic Diagram



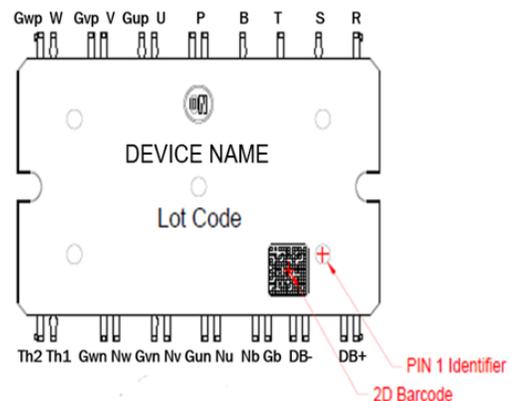
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DIP26  
CASE 181AD

#### MARKING DIAGRAM



#### ORDERING INFORMATION

Device	Package	Shipping
NXH35C120L2C2SG	DIP26 (Pb-Free)	6 Units / Tube
NXH35C120L2C2S1G	DIP26 (Pb-Free)	6 Units / Tube

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

# NXH35C120L2C2SG/S1G

## MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
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### IGBT

Collector–Emitter Voltage	$V_{CES}$	1200	V
Gate–Emitter Voltage	$V_{GE}$	$\pm 20$	V
Continuous Collector Current @ $T_c = 80^\circ\text{C}$ ( $T_{VJmax} = 175^\circ\text{C}$ )	$I_C$	35	A
Pulsed Collector Current	$I_{Cpulse}$	105	A

### DIODE

Peak Repetitive Reverse Voltage	$V_{RRM}$	1200	V
Continuous Forward Current @ $T_c = 80^\circ\text{C}$ ( $T_{VJmax} = 175^\circ\text{C}$ )	$I_F$	35	A
Repetitive Peak Forward Current ( $T_J = 175^\circ\text{C}$ )	$I_{FRM}$	105	A

### RECTIFIER DIODE

Peak Repetitive Reverse Voltage	$V_{RRM}$	1600	V
Continuous Forward Current @ $T_c = 80^\circ\text{C}$ ( $T_{VJmax} = 150^\circ\text{C}$ )	$I_F$	35	A
Repetitive Peak Forward Current ( $T_J = 150^\circ\text{C}$ )	$I_{FRM}$	105	A
$I^2t$ Value (10 ms sin180°) @ 25°C (10 ms sin180°) @ 150°C	$I^2t$	1126 510	A <sup>2</sup> t
Surge Current (10 ms sin180°) @ 25°C	$I_{FSM}$	520	A

### THERMAL PROPERTIES

Storage Temperature Range	$T_{stg}$	–40 to +125	°C
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### INSULATION PROPERTIES

Isolation Test Voltage, $t = 1$ s, 50 Hz	$V_{is}$	3000	$V_{RMS}$
Internal Isolation		Al <sub>2</sub> O <sub>3</sub>	
Creepage Distance		6.0	mm
Clearance Distance		6.0	mm
Comperative Tracking Index	CTI	> 400	

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.

1. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.

# NXH35C120L2C2SG/S1G

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit	
<b>IGBT CHARACTERISTICS</b>							
Collector–Emitter Cutoff Current	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 1200 V	I <sub>CES</sub>	–	–	250	μA	
Collector–Emitter Saturation Voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 35 A, T <sub>J</sub> = 25°C	V <sub>CE(sat)</sub>	–	1.8	2.4	V	
	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 35 A, T <sub>J</sub> = 150°C		–	1.9	–		
Gate–Emitter Threshold Voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 4.25 mA	V <sub>GE(TH)</sub>	4.8	6	6.8	V	
Gate Leakage Current	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0 V	I <sub>GES</sub>	–	–	400	nA	
Turn-on Delay Time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω	t <sub>d(on)</sub>	–	104	–	ns	
Rise Time		t <sub>r</sub>	–	64	–		
Turn-off Delay Time		t <sub>d(off)</sub>	–	277	–		
Fall Time		t <sub>f</sub>	–	53	–		
Turn-on Switching Loss per Pulse		E <sub>on</sub>	–	2900	–		μJ
Turn-off Switching Loss per Pulse		E <sub>off</sub>	–	1200	–		
Turn-on Delay Time	T <sub>J</sub> = 150°C V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω	t <sub>d(on)</sub>	–	168	–	ns	
Rise Time		t <sub>r</sub>	–	72	–		
Turn-off Delay Time		t <sub>d(off)</sub>	–	320	–		
Fall Time		t <sub>f</sub>	–	165	–		
Turn-on Switching Loss per Pulse		E <sub>on</sub>	–	4030	–		μJ
Turn-off Switching Loss per Pulse		E <sub>off</sub>	–	2200	–		
Input Capacitance	V <sub>CE</sub> = 20 V, V <sub>GE</sub> = 0 V, f = 100 kHz	C <sub>ies</sub>	–	8333	–	pF	
Output Capacitance		C <sub>oes</sub>	–	298	–		
Reverse Transfer Capacitance		C <sub>res</sub>	–	175	–		
Total Gate Charge	V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A, V <sub>GE</sub> = 0 V ~ +15 V	Q <sub>g</sub>	–	360	–	nC	
Temperature under Switching Conditions		T <sub>vj op</sub>	–40	–	150	°C	
Thermal Resistance – Chip–to–Case		R <sub>thJC</sub>	–	0.57	–	°C/W	
Thermal Resistance – Chip–to–Heatsink	Thermal grease, Thickness ≈ 3 mil, λ = 2.8 W/mK	R <sub>thJH</sub>	–	0.97	–	°C/W	

## DIODE CHARACTERISTICS

Brake Diode Reverse Leakage Current	V <sub>R</sub> = 1200 V	I <sub>R</sub>	–	–	200	μA
Diode Forward Voltage	I <sub>F</sub> = 35 A, T <sub>J</sub> = 25°C	V <sub>F</sub>	–	2.2	2.7	V
	I <sub>F</sub> = 35 A, T <sub>J</sub> = 150°C		–	2	–	
Reverse Recovery Time	T <sub>J</sub> = 25°C V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω	t <sub>rr</sub>	–	224	–	ns
Reverse Recovery Charge		Q <sub>rr</sub>	–	1.51	–	μC
Peak Reverse Recovery Current		I <sub>RPM</sub>	–	18	–	A
Reverse Recovery Energy		E <sub>rr</sub>	–	410	–	μJ
Reverse Recovery Time		t <sub>rr</sub>	–	532	–	ns
Reverse Recovery Charge	T <sub>J</sub> = 150°C V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω	Q <sub>rr</sub>	–	5.36	–	μC
Peak Reverse Recovery Current		I <sub>RPM</sub>	–	30	–	A
Reverse Recovery Energy		E <sub>rr</sub>	–	1983	–	μJ
Temperature under Switching Conditions			T <sub>vj op</sub>	–40	–	150
Thermal Resistance – Chip–to–Case		R <sub>thJC</sub>	–	0.94	–	°C/W
Thermal Resistance – Chip–to–Heatsink	Thermal grease, Thickness ≈ 3 mil, λ = 2.8 W/mK	R <sub>thJH</sub>	–	1.5	–	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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### RECTIFIER DIODE CHARACTERISTICS

Rectifier Reverse Leakage Current	$V_R = 1600\text{ V}$	$I_R$	–	–	200	$\mu\text{A}$
Rectifier Forward Voltage	$I_F = 35\text{ A}, T_J = 25^\circ\text{C}$	$V_F$	–	1.1	1.5	V
	$I_F = 35\text{ A}, T_J = 150^\circ\text{C}$		–	1	–	
Temperature under Switching Conditions		$T_{vj\text{ op}}$	–40	–	150	$^\circ\text{C}$
Thermal Resistance – Chip-to-Case		$R_{thJC}$	–	0.55	–	$^\circ\text{C/W}$
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness $\approx 3\text{ mil}$ , $\lambda = 2.8\text{ W/mK}$	$R_{thJH}$	–	1.28	–	$^\circ\text{C/W}$

### THERMISTOR CHARACTERISTICS

Nominal Resistance	$T = 25^\circ\text{C}$	$R_{25}$	–	5	–	$\text{k}\Omega$
Nominal Resistance	$T = 100^\circ\text{C}$	$R_{100}$	–	493.3	–	$\Omega$
Deviation of R25		$\Delta R/R$	–5	–	5	%
Power Dissipation		$P_D$	–	20	–	mW
Power Dissipation Constant			–	1.4	–	mW/K
B-value	B(25/50), tolerance $\pm 2\%$		–	3375	–	K
B-value	B(25/100), tolerance $\pm 2\%$		–	3433	–	K

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 – INVERTER/BRAKE IGBT & DIODE

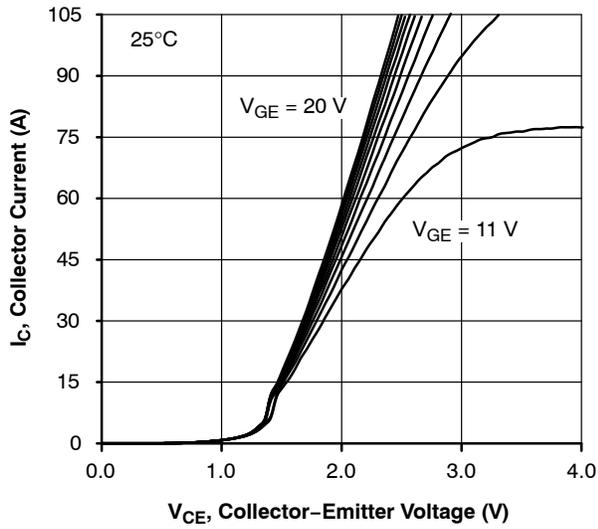


Figure 3. IGBT Typical Output Characteristic

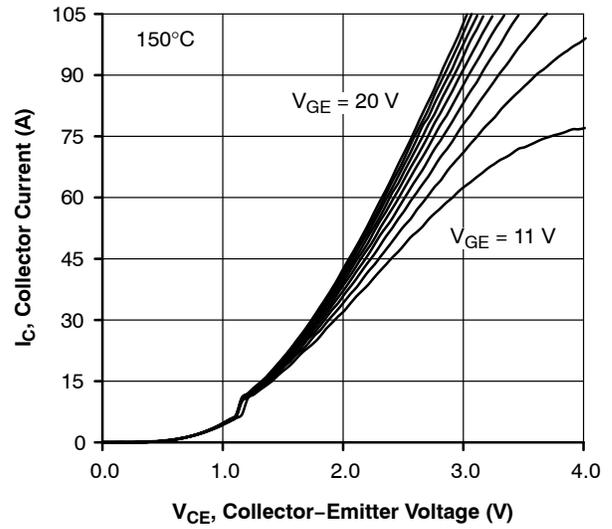


Figure 4. IGBT Typical Output Characteristic

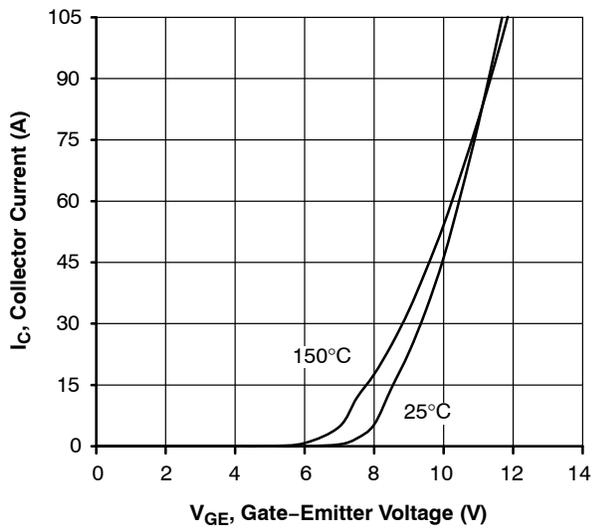


Figure 5. IGBT Typical Transfer Characteristic

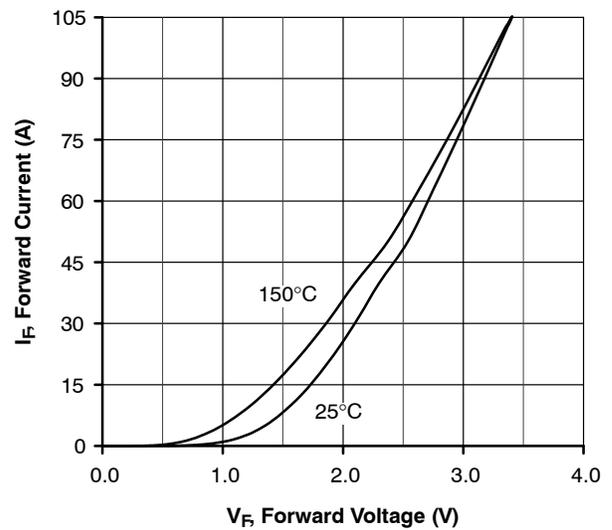


Figure 6. Diode Typical Forward Characteristic

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## TYPICAL CHARACTERISTICS – INVERTER/BRAKE IGBT & DIODE (Continued)

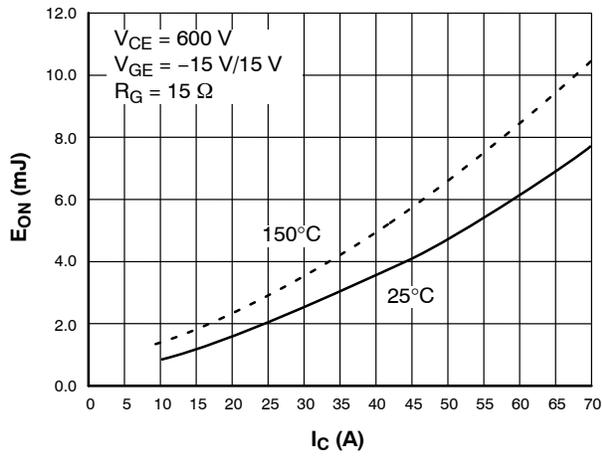


Figure 7. Typical Turn On Loss vs  $I_C$

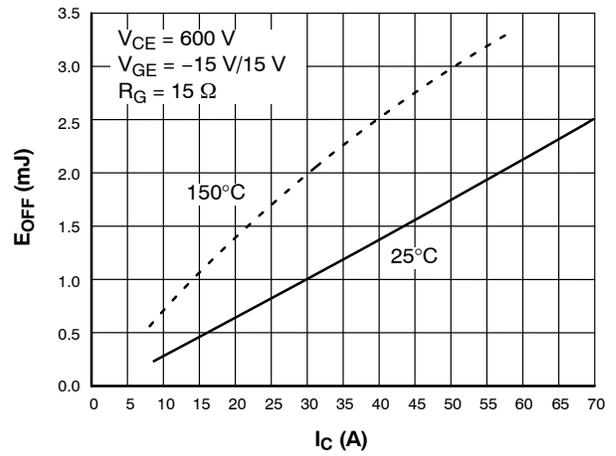


Figure 8. Typical Turn Off Loss vs  $I_C$

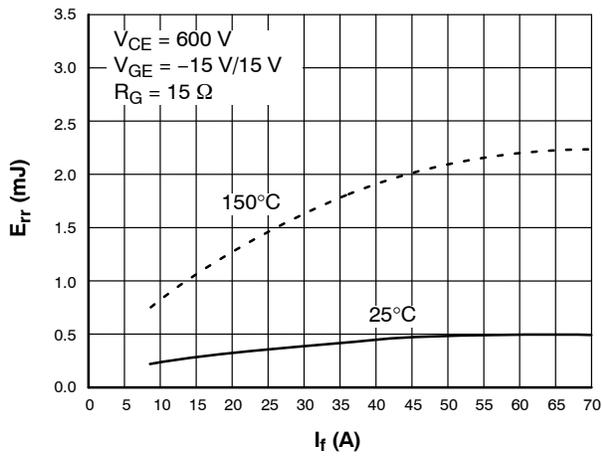


Figure 9. Typical Reverse Recovery Energy vs  $I_C$

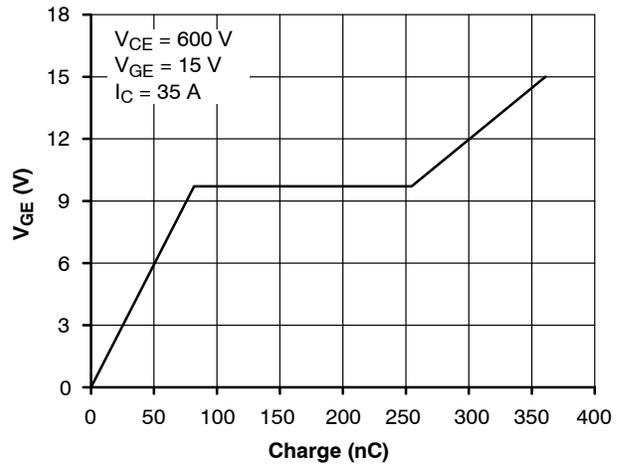


Figure 10. Gate Voltage vs. Gate Charge

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## TYPICAL CHARACTERISTICS – INVERTER/BRAKE IGBT & DIODE (Continued)

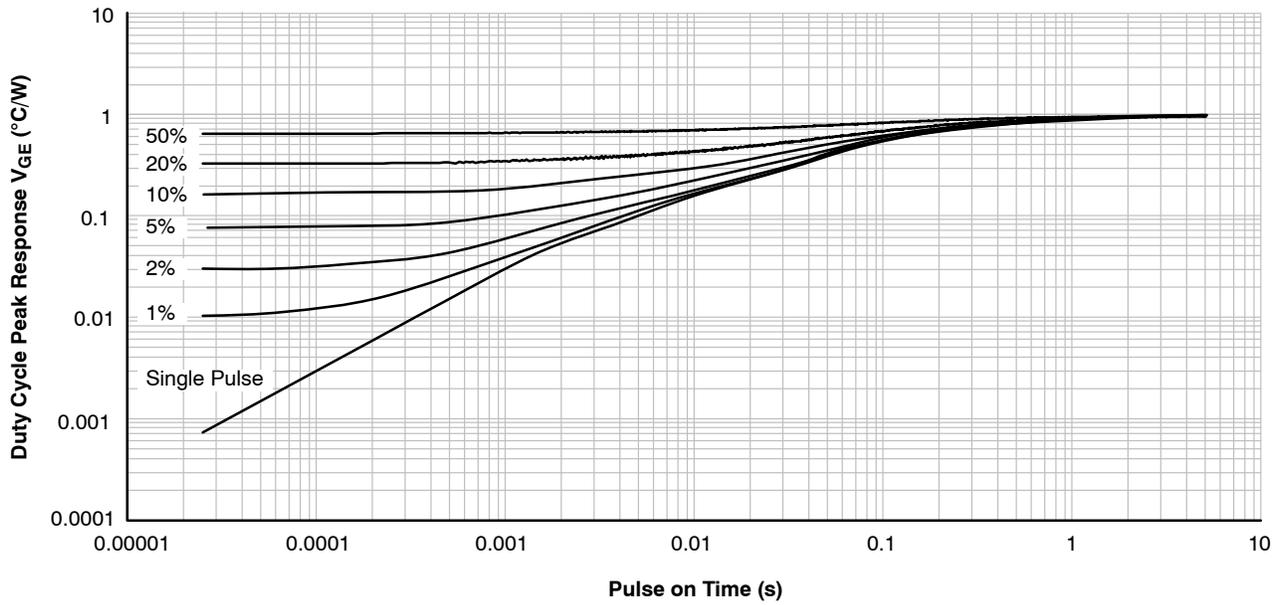


Figure 11. IGBT Junction-to-Heatsink Transient Thermal Impedance

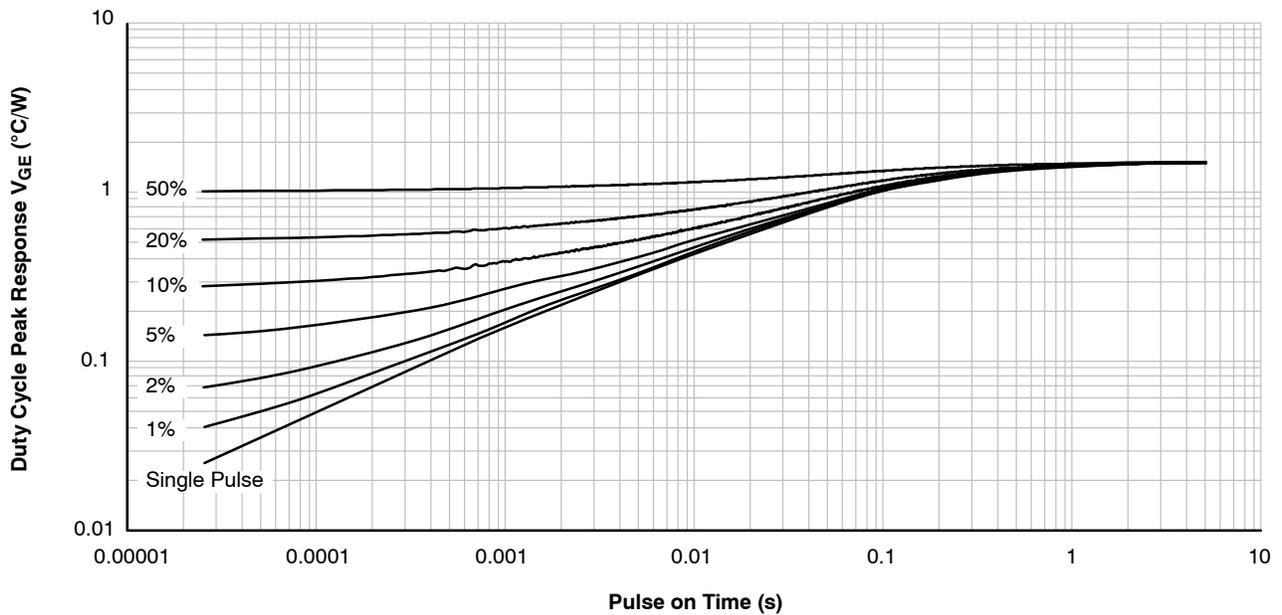


Figure 12. Diode Junction-to-Heatsink Transient Thermal Impedance

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## TYPICAL CHARACTERISTICS – RECTIFIER

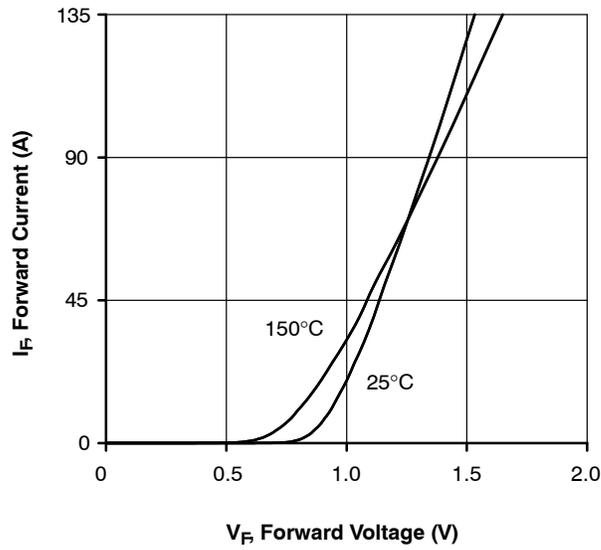


Figure 13. Rectifier Typical Forward Characteristic

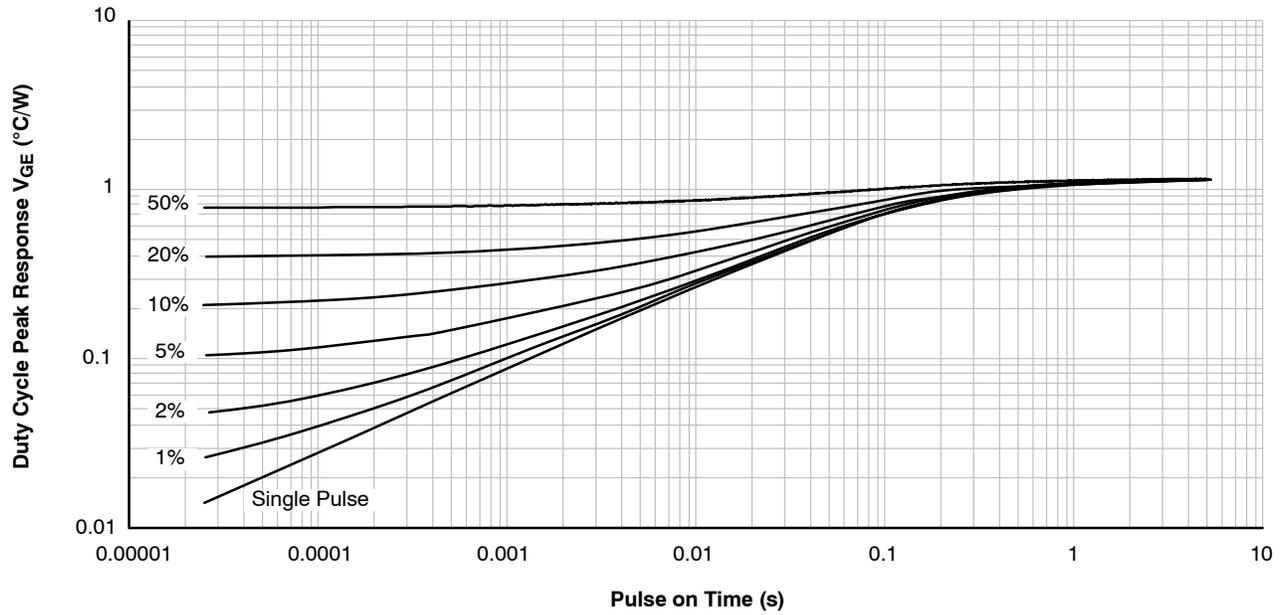
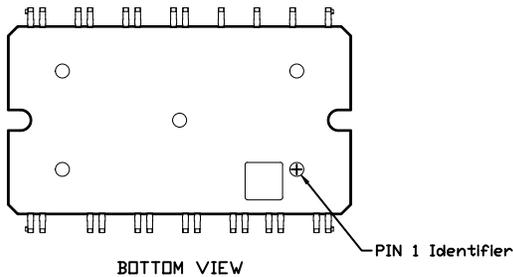
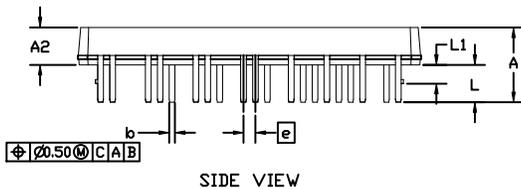
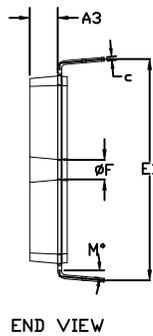
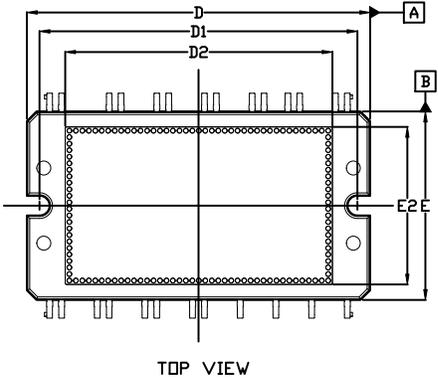
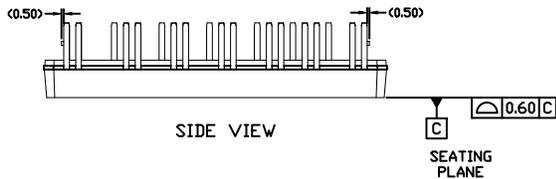


Figure 14. Rectifier Junction-to-Heatsink Transient Thermal Impedance

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## PACKAGE DIMENSIONS

DIP26 67.8x40  
CASE 181AD  
ISSUE A



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
4. DIMENSIONS *b* AND *c* APPLY TO PLATED LEADS
5. POSITION OF THE LEADS IS DETERMINED AT THE ROOT OF THE LEAD WHERE IT EXITS THE PACKAGE BODY
6. MISSING PINS ARE 3,4,7,10,11,14,15,18,19,22,23,24,29, 30,33,34,37,38,41,42,44,45,47,48,50,51

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	15.50	16.00	16.50
A2	7.80	8.00	8.20
A3	6.00 REF		
b	1.10	1.20	1.30
c	0.70	0.80	0.90
D	72.70	73.20	73.70
D1	67.30	67.80	68.30
D2	57.30 REF		
E	39.70	40.20	40.70
E1	46.70	47.20	47.70
E2	33.87 REF		
e	2.54 BSC		
F	4.00	4.20	4.40
L	8.00 REF		
L1	3.50	4.00	4.50
M	4°	5°	6°

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