

# TMPIM 35 A Enhances CIB Module

## NXH35C120L2C2ESG

The NXH35C120L2C2ESG is a transfer-molded power module with low thermal resistance substrate 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.

### Features

- Low Thermal Resistance Substrate for Low Thermal Resistance
- 6 mm Clearance Distance between 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

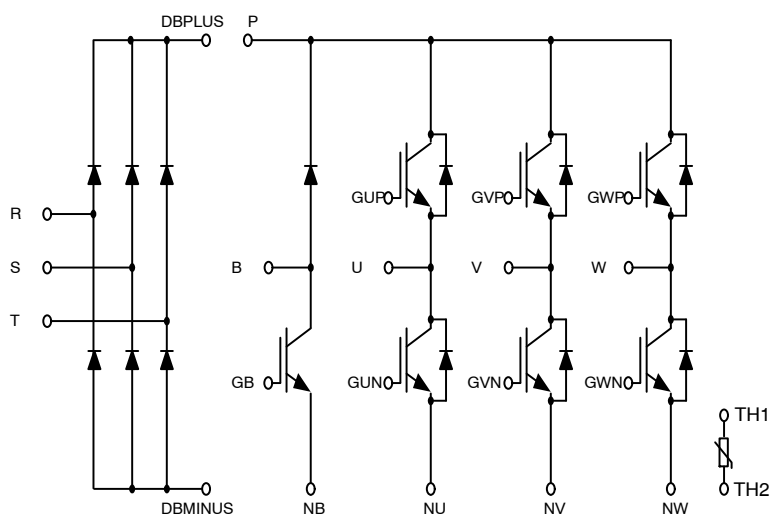
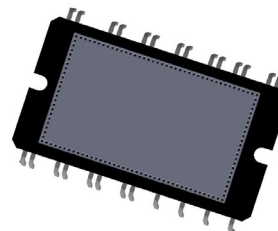


Figure 1. NXH35C120L2C2ESG Schematic Diagram



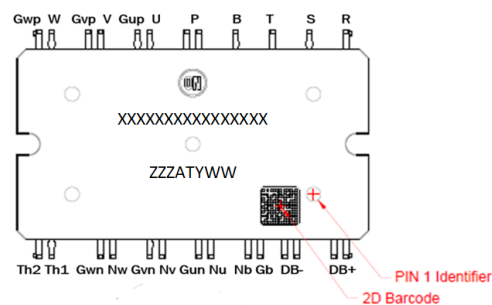
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DIP26 67.8x40  
CASE 181AD

### MARKING DIAGRAM



XXXXX = Specific Device Code  
ZZZ = Assembly Lot Code  
AT = Assembly & Test Site Code  
YYWW = Year and Work Week Code

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NXH35C120L2C2ESG	DIP26 (Pb-Free)	6 Units / Tube

# NXH35C120L2C2ESG

## MAXIMUM RATINGS

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 @ $T_C = 80^\circ\text{C}$ ( $T_{V_{Jmax}} = 175^\circ\text{C}$ )	$I_C$	35	A
Pulsed Collector Current	$I_{Cpulse}$	105	A

### DIODE

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

### RECTIFIER DIODE

Peak Repetitive Reverse Voltage	$V_{RRM}$	1600	V
Continuous Forward Current @ $T_C = 80^\circ\text{C}$ ( $T_{V_{Jmax}} = 150^\circ\text{C}$ )	$I_F$	35	A
Repetitive Peak Forward Current	$I_{FRM}$	105	A
$I^2t$ value (10 ms single half-sine wave) @ $25^\circ\text{C}$ (10 ms single half-sine wave) @ $150^\circ\text{C}$	$I^2t$	1126 510	$\text{A}^2\text{t}$
Surge current (10 ms sin180°) @ $25^\circ\text{C}$	$I_{FSM}$	520	A

### THERMAL PROPERTIES

Storage Temperature range	$T_{stg}$	–40 to 125	$^\circ\text{C}$
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### INSULATION PROPERTIES

Isolation test voltage, $t = 1$ sec, 50Hz	$V_{is}$	3000	$V_{RMS}$
Internal isolation		HPS	
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.

# NXH35C120L2C2ESG

## 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–heatsink	Thermal grease, Thickness – 3 mil, λ = 2.8 W/mK	R <sub>thJH</sub>	–	0.83	–	°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>RRM</sub>	–	18	–	A
Reverse Recovery Energy		E <sub>rr</sub>	–	410	–	μJ
Reverse Recovery 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>rr</sub>		532		ns
Reverse Recovery Charge		Q <sub>rr</sub>	–	5.36	–	μC
Peak Reverse Recovery Current		I <sub>RRM</sub>	–	30	–	A
Reverse Recovery Energy		E <sub>rr</sub>	–	1983	–	μJ
Temperature under switching conditions		T <sub>vj op</sub>	–40		150	°C
Thermal Resistance – chip-to–heatsink	Thermal grease, Thickness – 3mil, λ = 2.8 W/mK	R <sub>thJH</sub>	–	1.4	–	°C/W

# NXH35C120L2C2ESG

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°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 <sub>R</sub> = 1600 V	I <sub>R</sub>	–	–	200	μA
Rectifier Forward Voltage	I <sub>F</sub> = 35 A, T <sub>J</sub> = 25°C	V <sub>F</sub>	–	1.1	1.5	V
	I <sub>F</sub> = 35 A, T <sub>J</sub> = 150°C		–	1	–	
Temperature under switching conditions		T <sub>vj op</sub>	–40		150	°C
Thermal Resistance – chip-to-heatsink	Thermal grease, Thickness – 3 mil, λ = 2.8 W/mK	R <sub>thJH</sub>	–	1.25	–	°C/W

### THERMISTOR CHARACTERISTICS

Nominal resistance	T = 25°C	R <sub>25</sub>	–	5	–	kΩ
Nominal resistance	T = 100°C	R <sub>100</sub>	–	493.3	–	Ω
Deviation of R25		ΔR/R	–5	–	5	%
Power dissipation		P <sub>D</sub>	–	20	–	mW
Power dissipation constant			–	1.4	–	mW/K
B-value	B(25/50), tolerance ±2%		–	3375	–	K
B-value	B(25/100), tolerance ±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

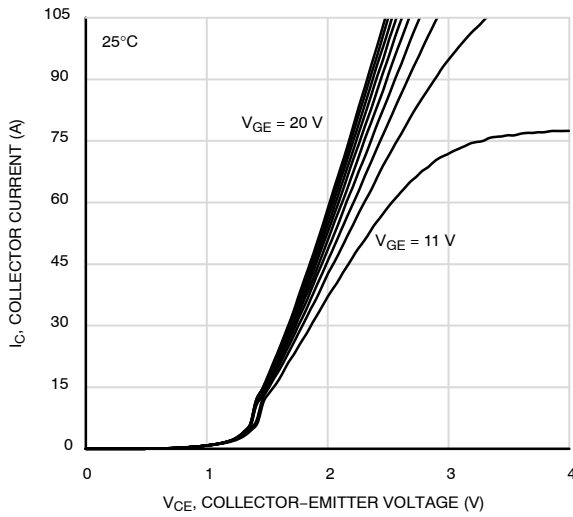


Figure 2. IGBT Typical Output Characteristic

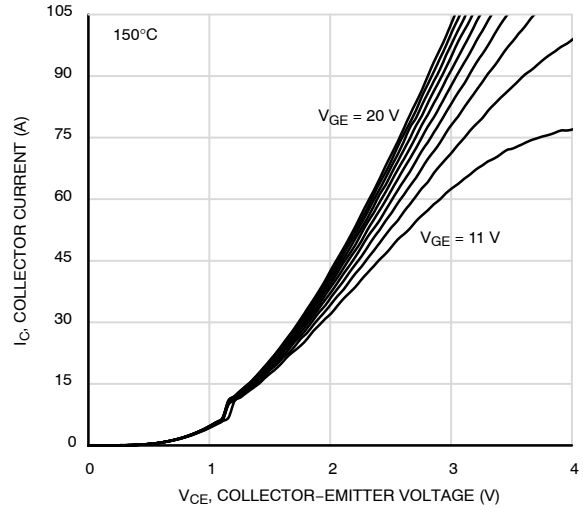


Figure 3. IGBT Typical Output Characteristic

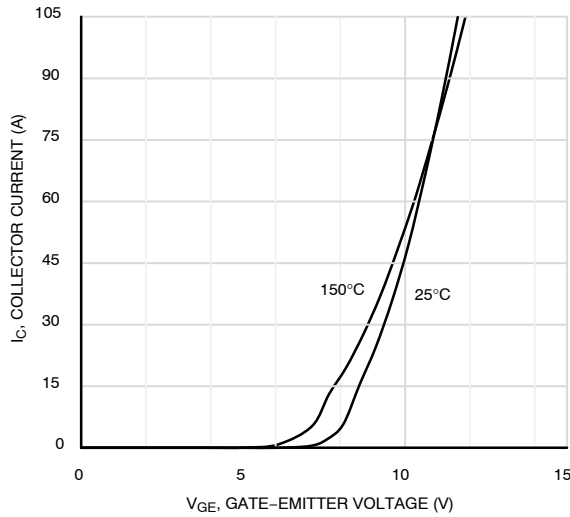


Figure 4. IGBT Typical Output Characteristic

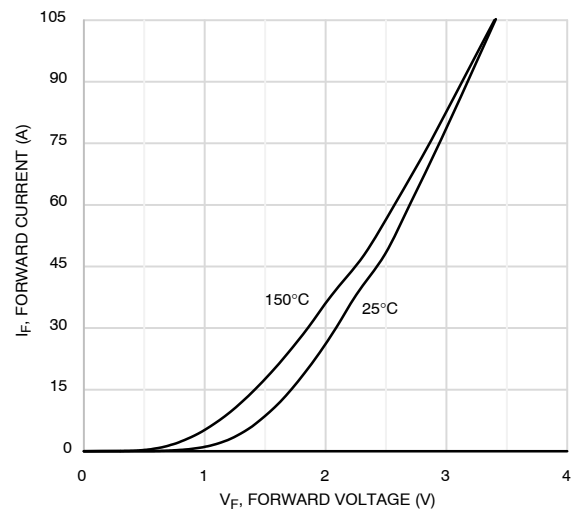


Figure 5. Diode Typical Forward Characteristic

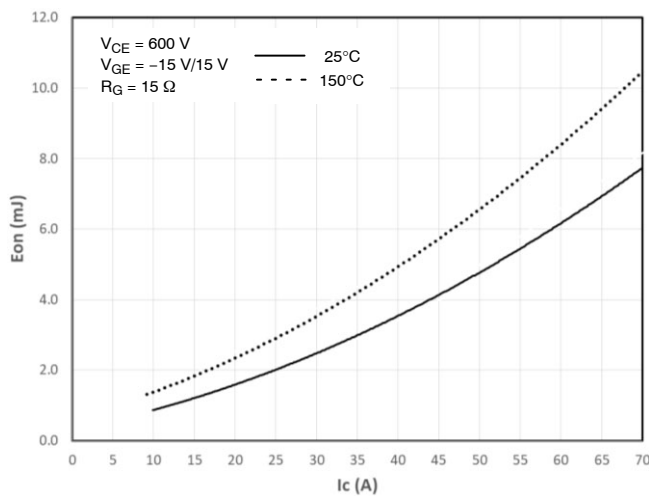


Figure 6. Typical Turn On Loss vs Ic

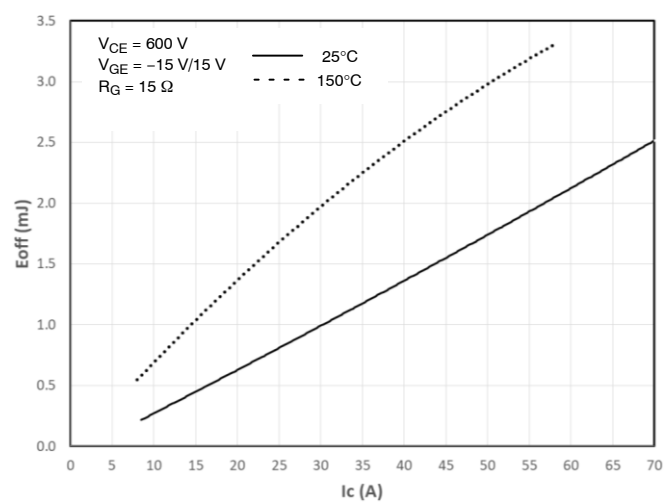


Figure 7. Typical Turn Off Loss vs Ic

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## TYPICAL CHARACTERISTICS – INVERTER/BRAKE IGBT & DIODE

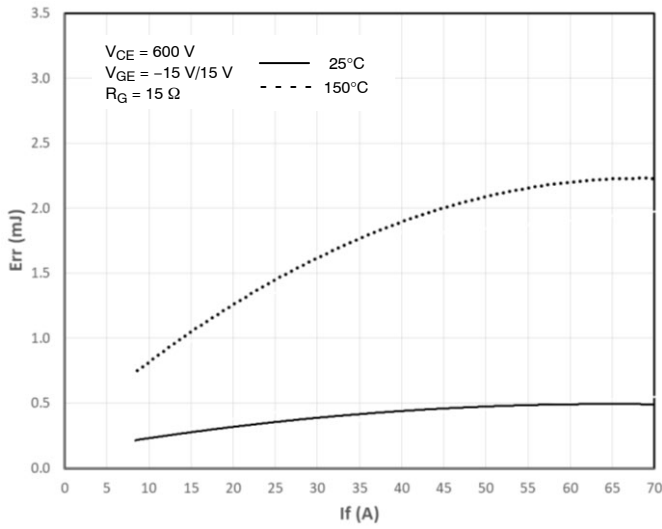


Figure 8. Typical Reverse Recovery Energy vs Ic

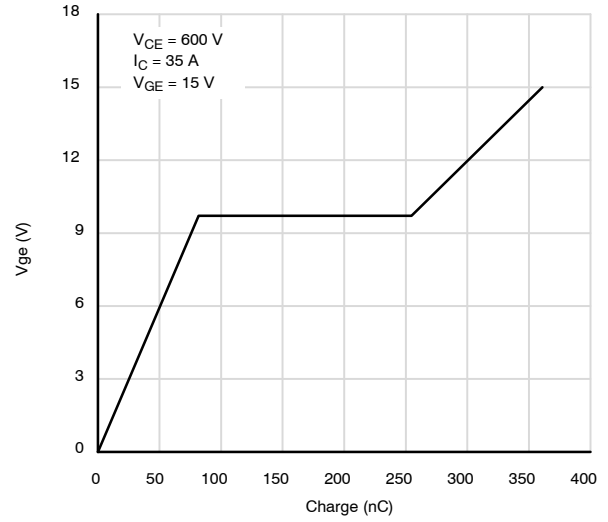


Figure 9. Gate Voltage vs. Gate Charge

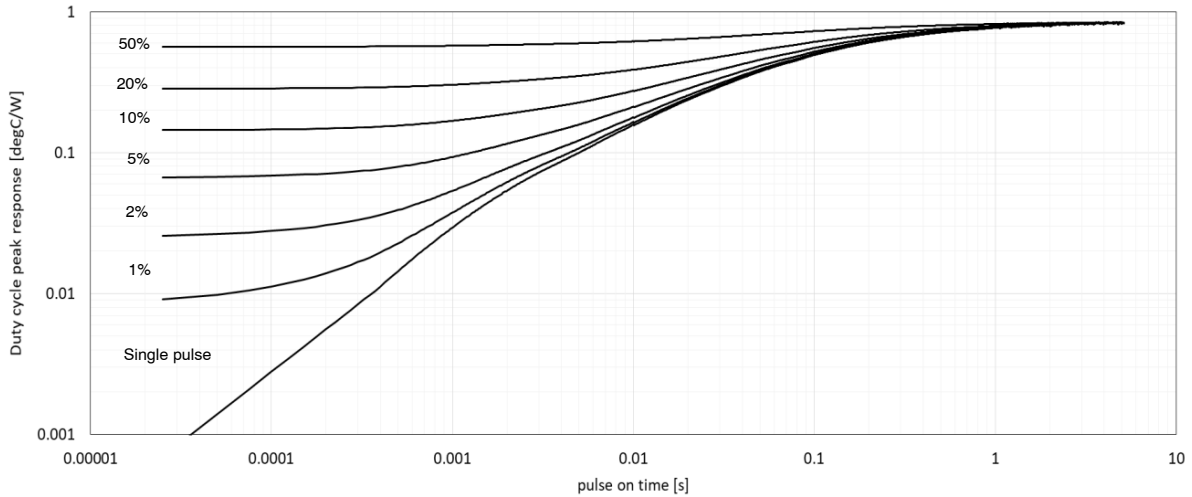


Figure 10. IGBT Junction-to-Heatsink Transient Thermal Impedance

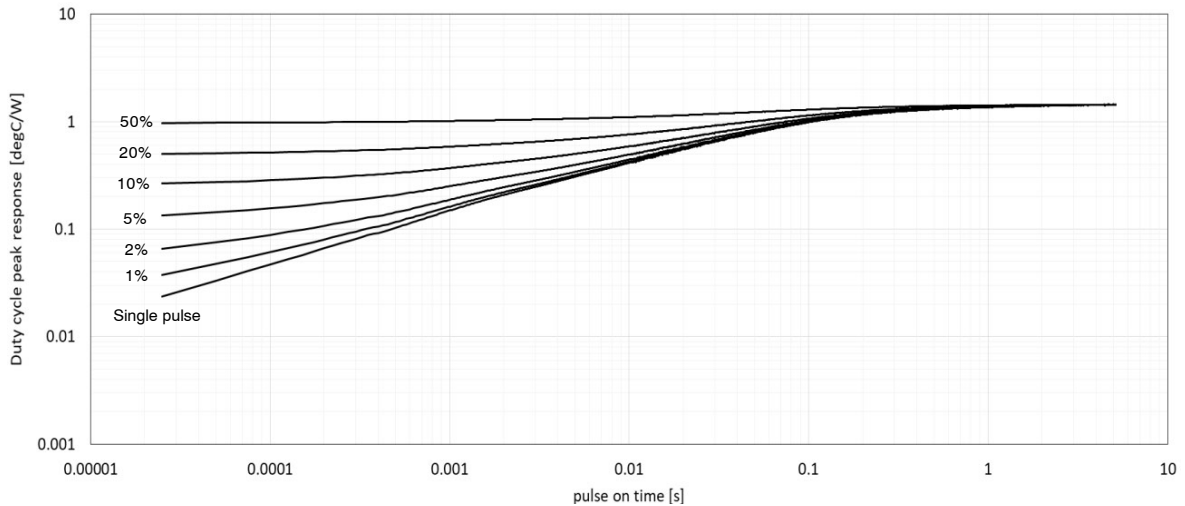


Figure 11. Diode Junction-to-Heatsink Transient Thermal Impedance

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## TYPICAL CHARACTERISTICS – RECTIFIER

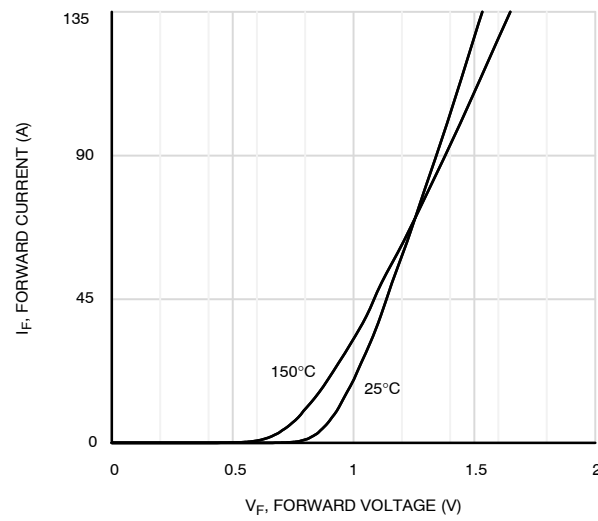


Figure 12. Rectifier Typical Forward Characteristic

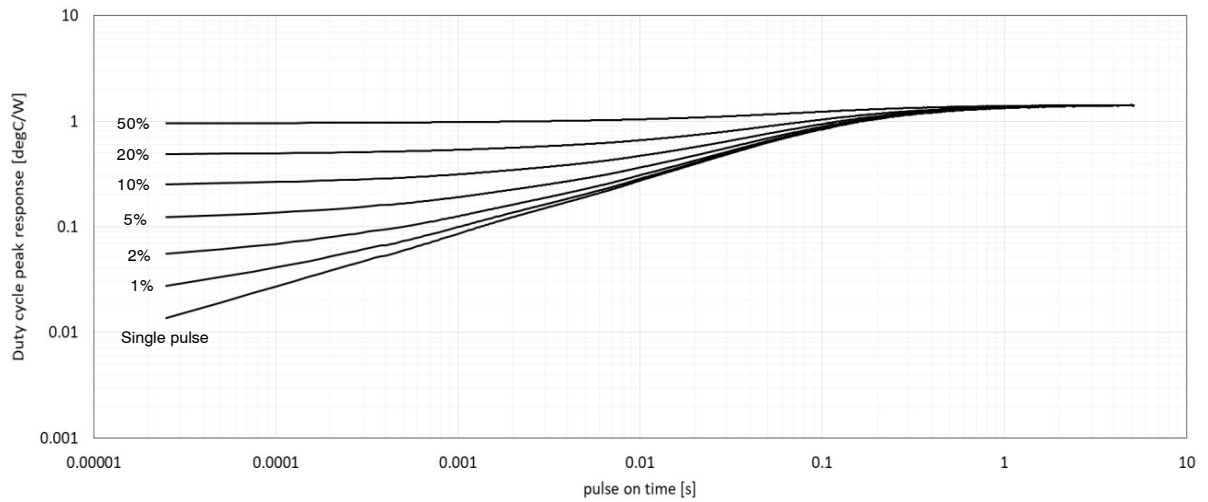


Figure 13. Rectifier Junction-to-Heatsink Transient Thermal Impedance

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