TMPIM 50 A CIB/CI Module

NXH50C120L2C2ESG, NXH50C120L2C2ES1G

The NXH50C120L2C2ESG is a transfer−molded power module with low thermal resistance substrate containing a converter-inverter-brake circuit consisting of six 50 A, 1600 V rectifiers, six 50 A, 1200 V IGBTs with inverse diodes, one 35 A, 1200 V brake IGBT with brake diode and an NTC thermistor.

The NXH50C120L2C2ES1G is a transfer−molded power module with low thermal resistance substrate containing a converter−inverter circuit consisting of six 50 A, 1600 V rectifiers, six 50 A, 1200 V IGBTs with inverse diodes, and an NTC thermistor.

Features

- Low Thermal Resistance Substrate for Low Thermal Resistance
- Lower Package Height than Standard Case Modules
- 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

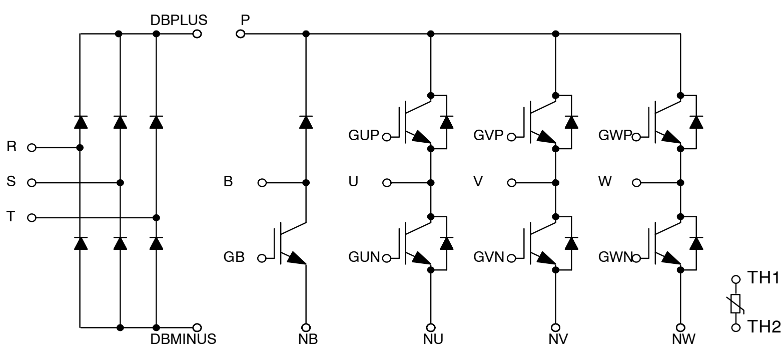

Figure 1. NXH50C120L2C2ESG Schematic Diagram

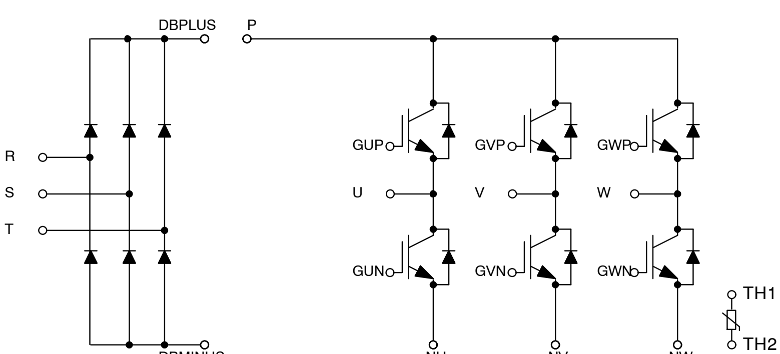

Figure 2. NXH50C120L2C2ES1G Schematic Diagram

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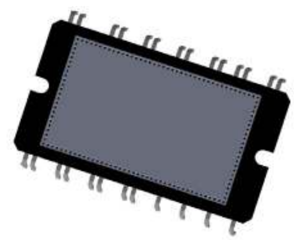

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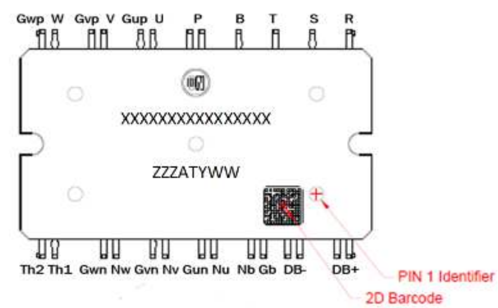
MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping†
NXH50C120L2C2ESG	DIP26 (Pb−Free)	6 Units / Tube
NXH50C120L2C2ES1G	DIP26 (Pb−Free)	6 Units / Tube

October, 2020 − Rev. 1

Publication Order Number:
NXH50C120L2C2/D

MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
IGBT (INVERTER, BRAKE)			
Collector-emitter Voltage	V_{CES}	1200	V
Gate-emitter Voltage	V_{GE}	±20	V
Inverter IGBT Continuous Collector Current @ T_C = 100°C (T_{VJmax} = 175°C)	I_C	50	A
Inverter IGBT Pulsed Collector Current (T_{VJmax} = 175°C)	I_{Cpulse}	150	A
Brake IGBT Continuous Collector Current @ T_C = 100°C (T_{VJmax} = 175°C)	I_C	35	A
Brake IGBT Pulsed Collector Current (T_{VJmax} = 175°C)	I_{Cpulse}	105	A
DIODE (INVERTER, BRAKE)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Inverter Diode Continuous Forward Current @ T_c = 80°C (Tv_{Jmax}= 17°C)	I_F	50	A
Inverter Diode Repetitive Peak Forward Current (T_{VJmax} = 175°C)	I_{FRM}	150	A
Inverter Diode I^2t value (60 Hz single half−sine wave)	I^2t	94	A^2t
Brake Diode Continuous Forward Current @ Tc = 80°C (T_{VJmax} = 175°C)	I_F	35	A
Brake Diode Repetitive Peak Forward Current (T_{VJmax} = 175°C)	I_{FRM}	105	A
Brake Diode I2t value (60 Hz single half−sine wave)	I^2t	46	A^2t
RECTIFIER DIODE			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current @ T_C = 80°C (T_{VJmax} = 150°C)	I_F	50	A
Repetitive Peak Forward Current (T_{VJmax} = 150°C)	I_{FRM}	150	A
I^2t value (60 Hz single half−sine wave) @ 25ºC (60 Hz single half−sine wave) @ 150ºC	I^2t	1126 510	A^2t
Surge current (10ms sin180º) @ 25ºC	IFSM	520	A
MODULE THERMAL PROPERTIES			
Storage Temperature Range	T_{stg}	−40 to 125	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	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.

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
INVERTER IGBT CHARACTERISTICS						
Collector-emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1200 V	I_{CES}	–	–	250	μA
Collector-emitter Saturation Voltage	V_{GE} = 15 V, I_C = 50 A, T_J = 25°C	$V_{CE(sat)}$	–	1.8	2.4	V
	V_{GE} = 15 V, I_C = 50 A, T_J = 150°C		–	2	–	
Gate-emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 6 mA	$V_{GE(TH)}$	4.8	6	6.8	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	400	nA
Turn-on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 50 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	144	–	ns
Rise Time		t_r	–	104	–	
Turn-off Delay Time		$t_{d(off)}$	–	380	–	
Fall Time		t_f	–	52	–	
Turn-on Switching Loss per Pulse		E_{on}	–	5870	–	μJ
Turn-off Switching Loss per Pulse		E_{off}	–	1700	–	
Turn-on Delay Time	T_J = 150°C V_{CE} = 600 V, I_C = 50 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	136	–	ns
Rise Time		t_r	–	112	–	
Turn-off Delay Time		$t_{d(off)}$	–	432	–	
Fall Time		t_f	–	184	–	
Turn-on Switching Loss per Pulse		E_{on}	–	9530	–	μJ
Turn-off Switching Loss per Pulse		E_{off}	–	3800	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz	C_{ies}	–	11897	–	pF
Output Capacitance		C_{oes}	–	416	–	
Reverse Transfer Capacitance		C_{res}	–	240	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 50 A, V_{GE} = 0 V ~ ±15 V	Q_g	–	558	–	nC
Temperature under switching conditions		Tvj op	–40		150	°C
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.26	–	°C/W
INVERSE DIODE CHARACTERISTICS						
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.9	2.7	V
	I_F = 50 A, T_J = 150°C		–	1.7	–	
Reverse Recovery Charge	T_J = 25°C V_{CE} = 600 V, I_C = 50 A V_{GE} = ±15 V, R_G = 15 Ω	Q_{rr}	–	2.58	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	20	–	A
Reverse Recovery Energy		E_{rr}	–	640	–	μJ
Reverse Recovery Charge	T_J = 150°C V_{CE} = 600 V, I_C = 50 A V_{GE} = ±15 V, R_G = 15 Ω	Q_{rr}	–	8.0	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	32.5	–	A
Reverse Recovery Energy		E_{rr}	–	2300	–	μJ
Temperature under switching conditions		Tvj op	–40		150	°C
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.42	–	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
RECTIFIER DIODE CHARACTERISTICS						
Diode Forward Voltage	I_F = 50 A, T_J = 25°C	V_F	–	1.2	1.6	V
	I_F = 50 A, T_J = 150°C		–	1.1	–	
Temperature under switching conditions		Tvj op	–40		150	°C
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.33	–	°C/W
BRAKE IGBT CHARACTERISTICS						
Collector-emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1200 V	I_{CES}	–	–	250	μA
Collector-emitter Saturation Voltage	V_{GE} = 15 V, I_C = 35 A, T_J = 25°C	$V_{CE(sat)}$	–	1.8	2.4	V
	V_{GE} = 15 V, I_C = 35 A, T_J = 125°C		–	1.9	–	
Gate-emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 4.25 mA	$V_{GE(TH)}$	4.8	6	6.8	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	400	nA
Turn–on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 35 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	104	–	ns
Rise Time		t_r	–	64	–	
Turn–off Delay Time		$t_{d(off)}$	–	277	–	
Fall Time		t_f	–	53	–	
Turn–on Switching Loss per Pulse		E_{on}	–	2900	–	μJ
Turn off Switching Loss per Pulse		E_{off}	–	1200	–	
Turn–on Delay Time	T_J = 150°C V_{CE} = 600 V, I_C = 35 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	168	–	ns
Rise Time		t_r	–	72	–	
Turn–off Delay Time		$t_{d(off)}$	–	320	–	
Fall Time		t_f	–	165	–	
Turn–on Switching Loss per Pulse		E_{on}	–	4030	–	μJ
Turn off Switching Loss per Pulse		E_{off}	–	2200	–	
Input Capacitance	V_{CE} = 20 V. V_{GE} = 0 V. f = 100 kHz	C_{ies}	–	8333	–	pF
Output Capacitance		C_{oes}	–	298	–	
Reverse Transfer Capacitance		C_{res}	–	175	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 35 A, V_{GE} = 0V ~ +15 V	Q_g	–	360	–	nC
Temperature under switching conditions		Tvj op	–40		150	°C
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.42	–	°C/W
BRAKE DIODE CHARACTERISTICS						
Brake Diode Reverse Leakage Current	VR = 1200 V	IR	–	–	200	μA
Diode Forward Voltage	I_F = 35 A, T_J = 25°C	V_F	–	2.2	2.7	V
	I_F = 35 A, T_J = 150°C		–	2	–	
Reverse Recovery Time	T_J = 25°C V_{CE} = 600 V, I_C = 35 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}		224		ns
Reverse Recovery Charge		Q_{rr}	–	1.51	–	°C
Peak Reverse Recovery Current		I_{RRM}	–	18	–	A
Reverse Recovery Energy		E_{rr}	–	410	–	μJ
Reverse Recovery Time	T_J = 150°C V_{CE} = 600 V, I_C = 35 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}	–	532	–	ns
Reverse Recovery Charge		Q_{rr}	–	5,36	–	°C
Peak Reverse Recovery Current		I_{RRM}	–	30	–	A
Reverse Recovery Energy		E_{rr}	–	1983	–	μJ
Temperature under switching conditions		Tvj op	–40		150	°C
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.65	–	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R_{25}	–	5	–	kΩ
Nominal Resistance	T = 100°C	R_{100}	–	493.3	–	Ω
Deviation of R25		ΔR/R	–5	–	5	%
Power Dissipation		P_D	–	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 IGBT & INVERSE DIODE

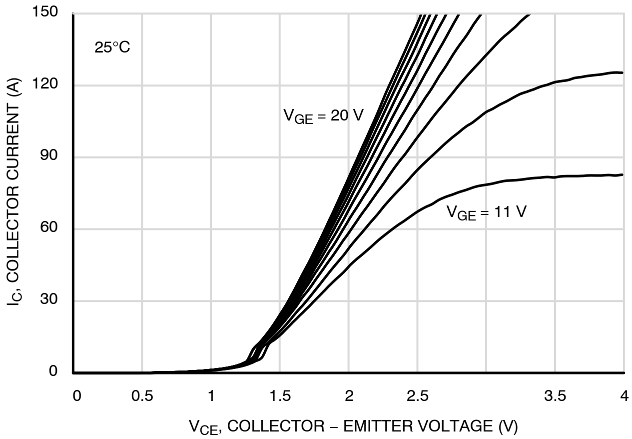


Figure 3. Inverter IGBT Typical Output Characteristic (25°C)

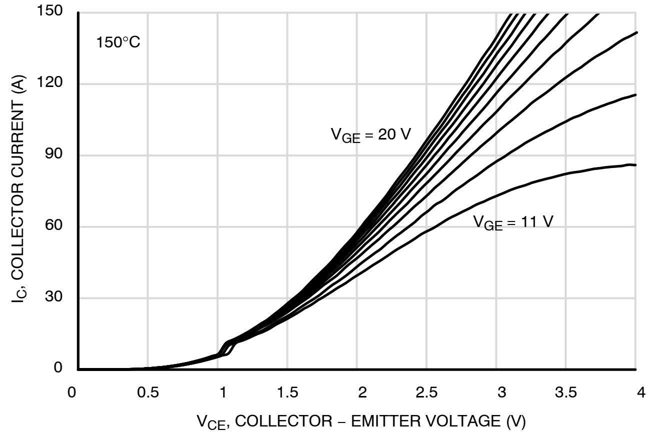


Figure 4. Inverter IGBT Typical Output Characteristic (150°C)

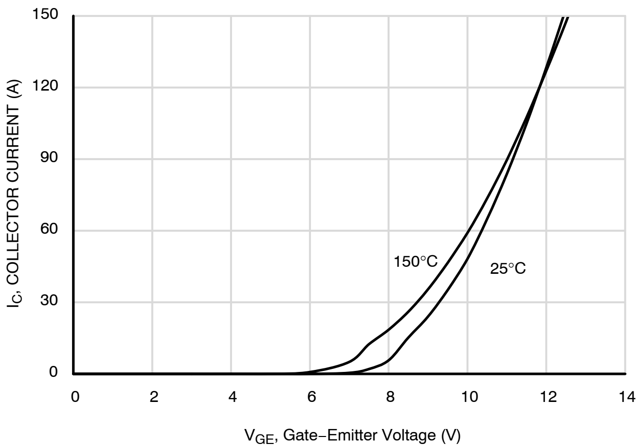


Figure 5. Inverter IGBT Typical Transfer Characteristic

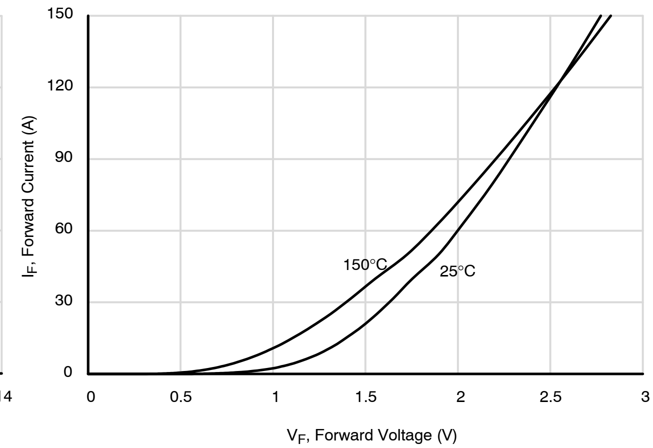


Figure 6. Inverter Diode Typical Forward Characteristic

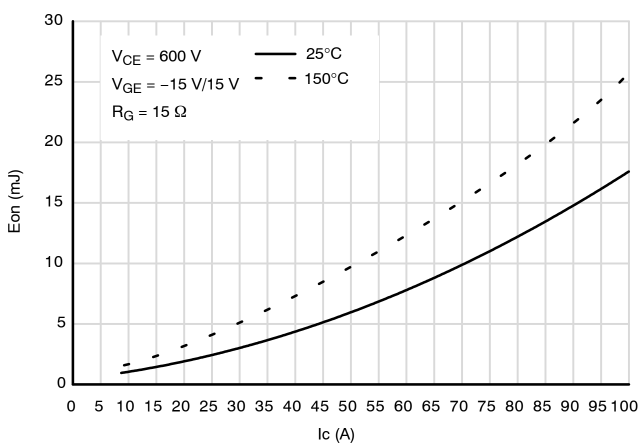


Figure 7. Inverter IGBT Typical Turn On Loss vs IC

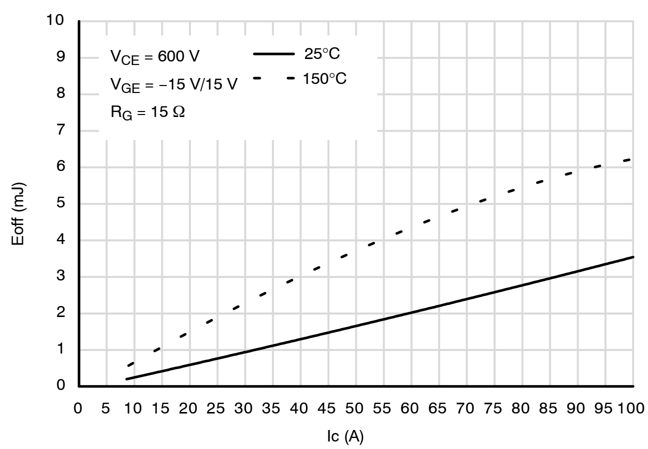


Figure 8. Inverter IGBT Typical Turn Off Loss vs IC

TYPICAL CHARACTERISTICS – INVERTER IGBT & INVERSE DIODE

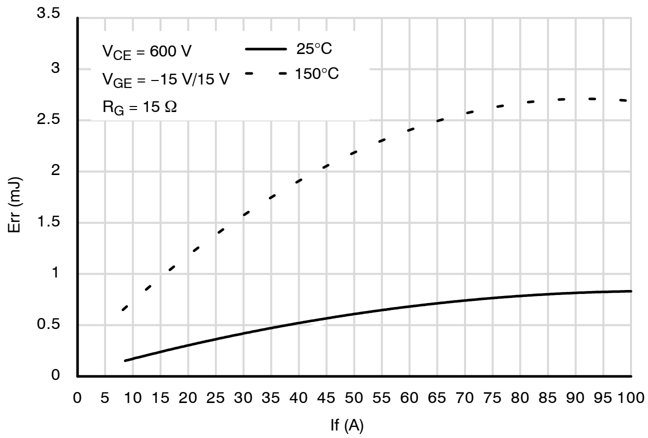


Figure 9. Inverter Diode Typical Reverse Recovery Energy vs IC

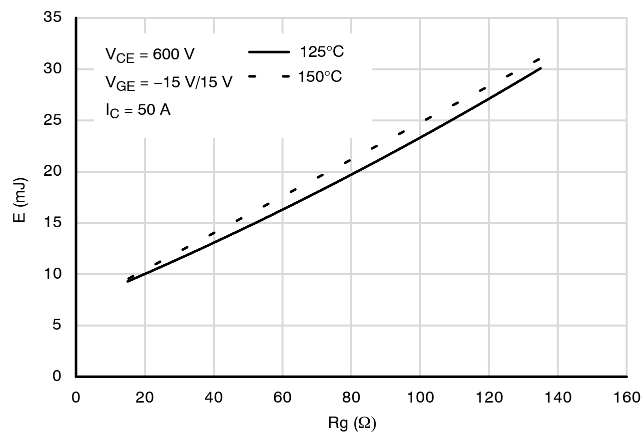


Figure 10. Inverter IGBT Typical Turn On Loss vs RG

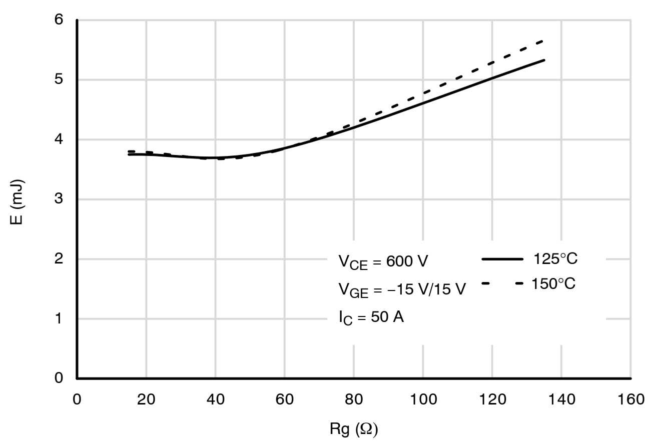


Figure 11. Inverter IGBT Typical Turn Off Loss vs RG

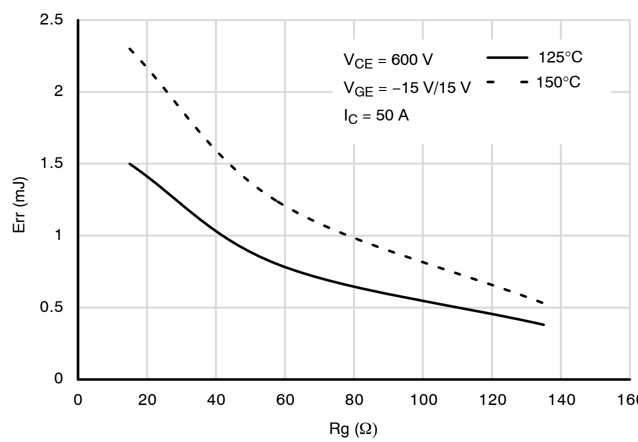


Figure 12. Inverter Diode Typical Reverse Recovery Energy vs RG

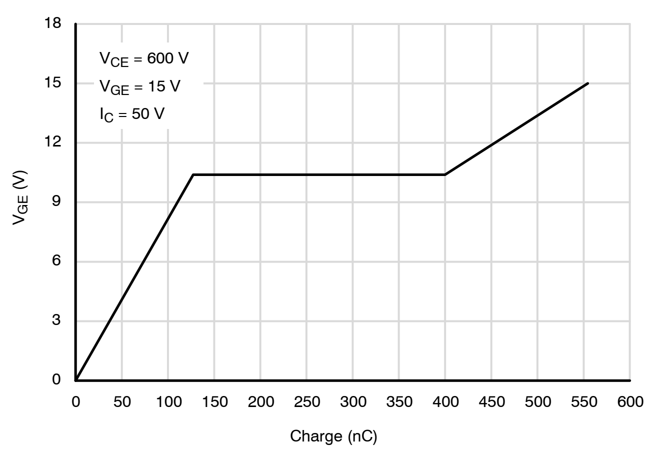


Figure 13. Inverter IGBT Gate Voltage vs Gate Charge

TYPICAL CHARACTERISTICS – INVERTER IGBT & INVERSE DIODE

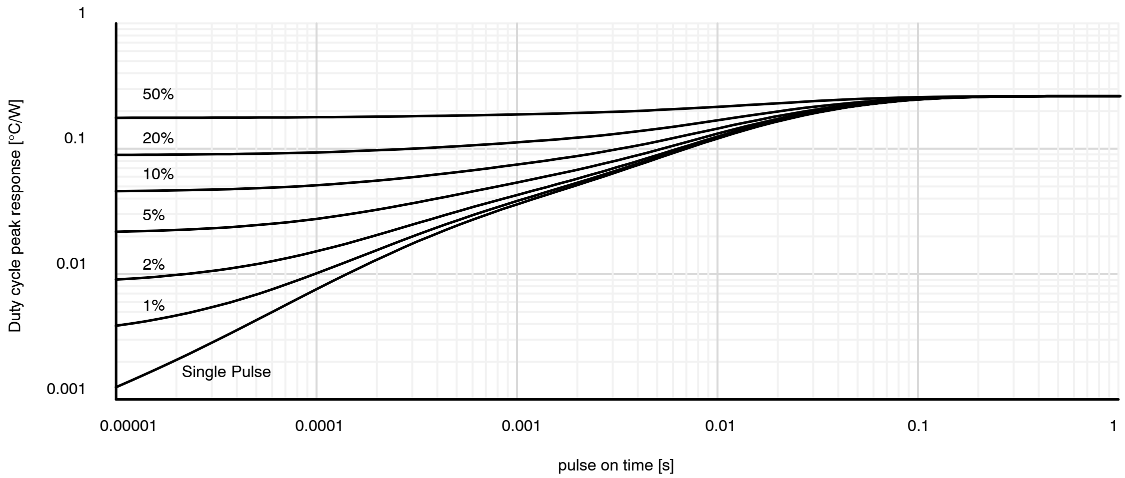


Figure 14. Inverter IGBT Junction−to−case Transient Thermal Impedance

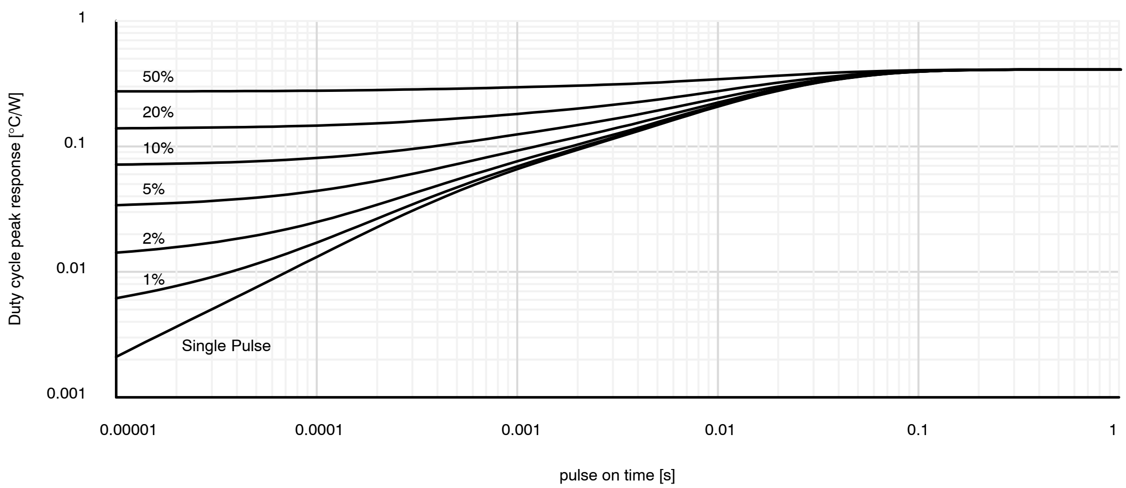


Figure 15. Inverter Diode Junction−to−case Transient Thermal Impedance

TYPICAL CHARACTERISTICS – BRAKE IGBT & BRAKE DIODE

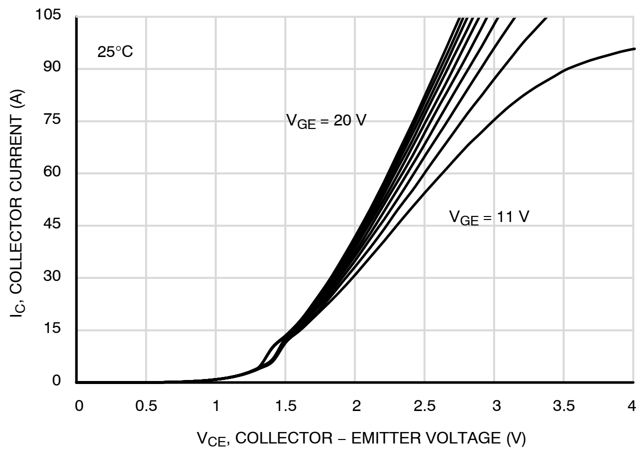


Figure 16. Brake IGBT Typical Output Characteristic (25°C)

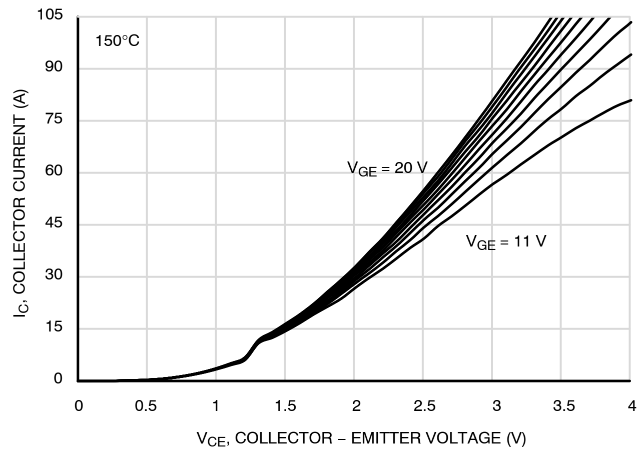


Figure 17. Brake IGBT Typical Output Characteristic (150°C)

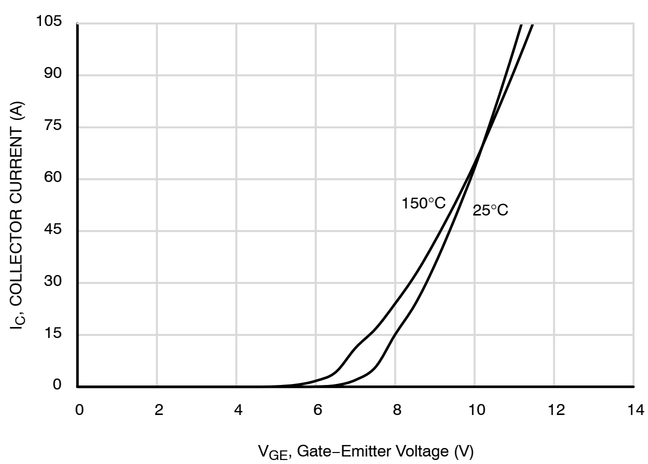


Figure 18. Brake IGBT Typical Transfer Characteristic

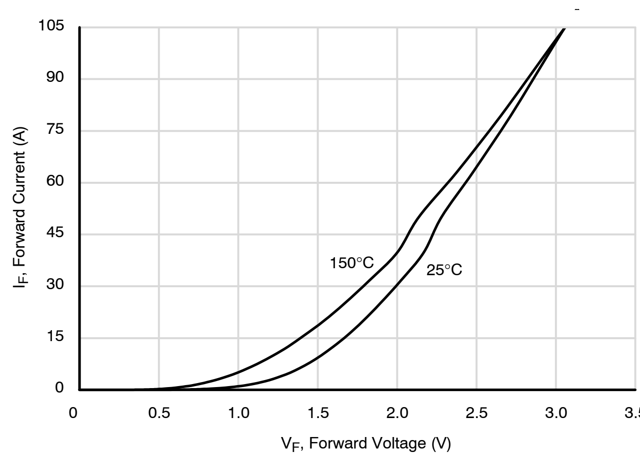


Figure 19. Brake Diode Typical Forward Characteristic

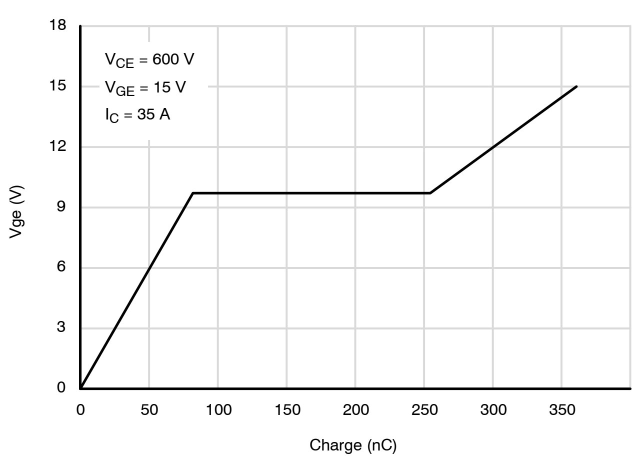


Figure 20. Brake IGBT Gate Voltage vs Gate Charge

TYPICAL CHARACTERISTICS – RECTIFIER

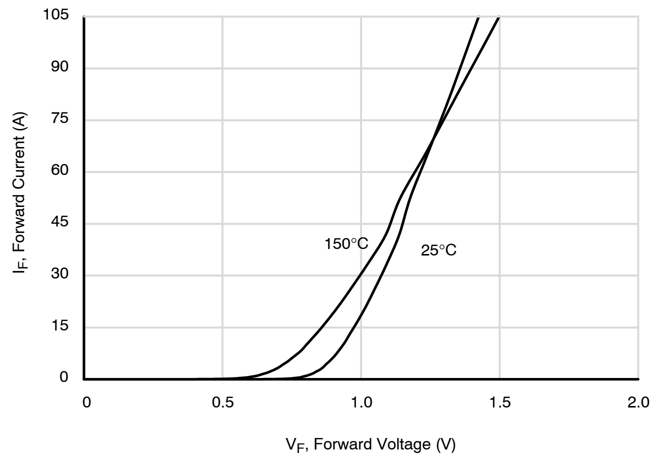


Figure 21. Rectifier Typical Forward Characteristic

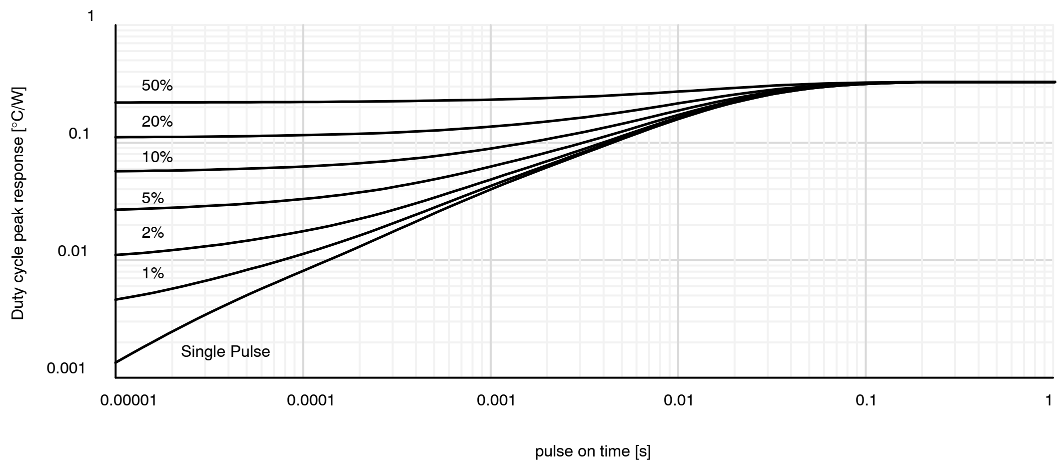
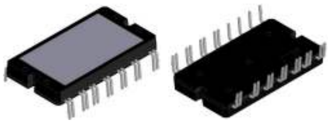


Figure 22. Rectifier Junction−to−Case Transient Thermal Impedance



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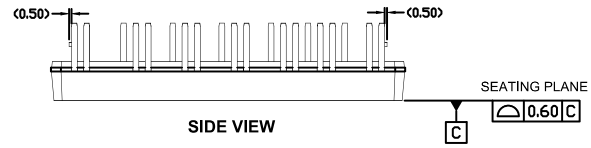
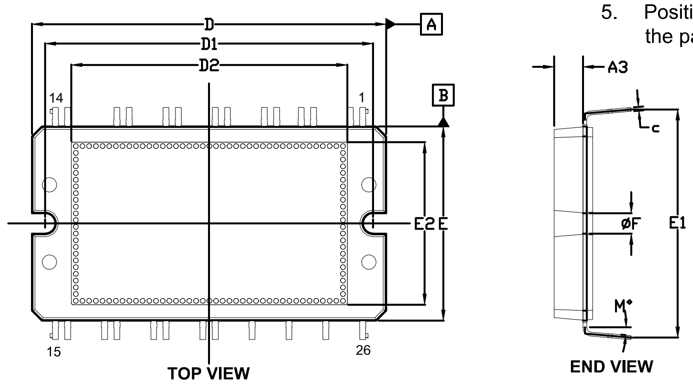
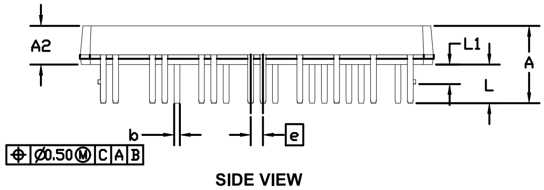
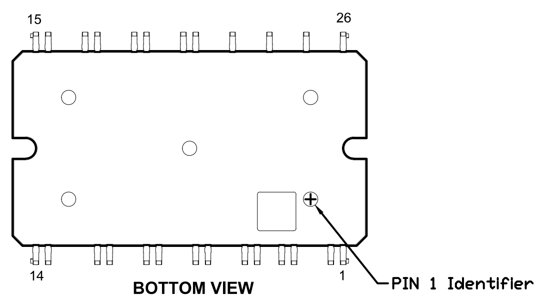
CASE 181AD
ISSUE B

DATE 05 AUG 2021









NOTES:

1. Dimensioning and tolerancing as per ASME Y14.5M, 2009
2. Controlling Dimension: Millimeters
3. Dimensions are exclusive of Burrs, Mold Flash, and Tiebar extrusions
4. Dimensions "b" and "c" apply to plated leads
5. Position of the leads is determine at the root of the lead where it exits the package body

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°

GENERIC
MARKING DIAGRAM*

XXX = Specific Device Code
ZZZ = Assembly Lot Code
AT = Assembly & Test Location
Y = Year
WW = Work Week

*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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