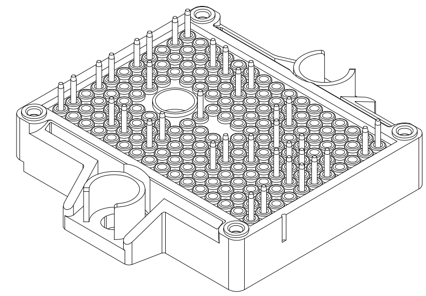
F2 Boost Power Module

NXH200B100H4F2SG, NXH200B100H4F2SG-R

The NXH200B100H4F2SG is a power module containing high−performance IGBTs with rugged anti−parallel diodes. The module also contains an on−board thermistor.



F2 PACKAGE
CASE 180CJ
SOLDER PINS

Features

- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- F2 Package with Solder Pins

Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies

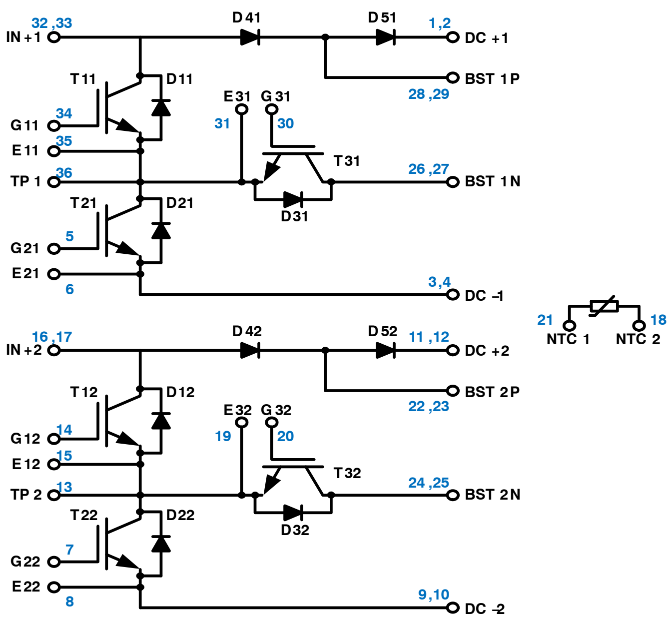
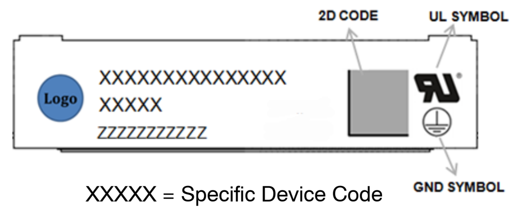


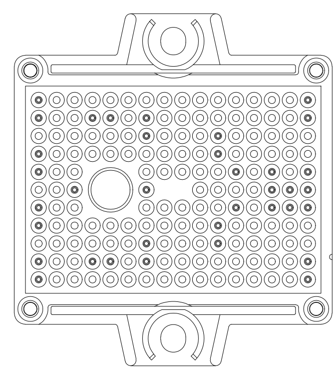
Figure 1. NXH200B100H4F2SG/NXH200B100H4F2SG−R Schematic Diagram

MARKING DIAGRAM



XXXXX = Specific Device Code
ZZZZ = Assembly Lot Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

Table 1. ABSOLUTE MAXIMUM RATINGS (Note 1) T_J = 25°C unless otherwise noted

Rating	Symbol	Value	Unit
BOOST IGBT (T11, T21, T12, T22)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current @ T_h = 80°C	I_C	100	A
Pulsed Collector Current	I_{Cpulse}	300	A
Maximum Power Dissipation @ T_h = 80°C	P_{tot}	93	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
BOOST IGBT INVERSE DIODE (D11, D21, D12, D22)			
Peak Repetitive Reverse Voltage	V_{RRM}	1600	V
Continuous Forward Current @ T_h = 80°C	I_F	30	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FRM}	90	A
Power Dissipation Per Diode @ T_h = 80°C	P_{tot}	37	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
PATH IGBT (T31, T32)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate−Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current @ T_h = 80°C	I_C	100	A
Pulsed Collector Current	I_{Cpulse}	300	A
Maximum Power Dissipation @ T_h = 80°C	P_{tot}	109	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
PATH IGBT INVERSE DIODE (D31, D32)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_h = 80°C	I_F	40	A
Repetitive Peak Forward Current	I_{FRM}	120	A
Power Dissipation Per Diode @ T_h = 80°C	P_{tot}	78	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
BOOST DIODE (D41, D51, D42, D52)			
Peak Repetitive Reverse Voltage	V_{RRM}	1200	V
Continuous Forward Current @ T_h = 80°C	I_F	40	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FRM}	120	A
Maximum Power Dissipation @ T_h = 80°C	P_{tot}	72	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	150	°C
THERMAL PROPERTIES			
Storage Temperature range	T_{stg}	−40 to 125	°C
INSULATION PROPERTIES			
Isolation test voltage, t = 1 sec, 50 Hz	V_{is}	3000	V_{RMS}
Creepage distance (pin to heatsink)		>12.7	mm

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.

Table 2. RECOMMENDED OPERATING RANGES

Rating	Symbol	Min	Max	Unit
Module Operating Junction Temperature	T_J	−40	150	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Table 3. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
BOOST IGBT CHARACTERISTICS (T11, T21, T12, T22)						
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	200	µA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 100 A, T_J = 25°C	$V_{CE(sat)}$	–	1.8	2.4	V
	V_{GE} = 15 V, I_C = 100 A, T_J = 150°C		–	2.1	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 100 mA	$V_{GE(TH)}$	3.9	5	6.3	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	800	nA
Turn−on Switching Loss per Pulse	T_J = 25°C V_{CE} = 600 V, I_C = 30 A V_{GE} = –5 V ~ 15 V, R_G = 10 Ω	E_{on}	–	0.57	–	mJ
Turn−off Switching Loss per Pulse		E_{off}	–	0.96	–	
Turn−on Switching Loss per Pulse	T_J = 125°C V_{CE} = 600 V, I_C = 30 A V_{GE} = –5 V ~ 15 V, R_G = 10 Ω	E_{on}	–	0.70	–	mJ
Turn−off Switching Loss per Pulse		E_{off}	–	1.60	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	6523	–	pF
Output Capacitance		C_{oes}	–	253	–	
Reverse Transfer Capacitance		C_{res}	–	26	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 100 A, V_{GE} = ±15 V	Q_g	–	326	–	nC
Thermal Resistance – chip−to−case		R_{thJC}	–	0.42	–	°C/W
Thermal Resistance – chip−to−heatsink	Thermal grease, Thickness ≈ 57 µm, λ = 2.87 W/mK	R_{thJH}	–	0.75	–	°C/W
BOOST IGBT INVERSE DIODE CHARACTERISTICS (D11, D21, D12, D22)						
Diode Forward Voltage	I_F = 30 A, T_J = 25°C	V_F	–	1	1.6	V
	I_F = 30 A, T_J = 150°C		–	0.94	–	
Thermal Resistance – chip−to−case		R_{thJC}	–	0.77	–	°C/W
Thermal Resistance – chip−to−heatsink	Thermal grease, Thickness ≈ 57 µm, λ = 2.87 W/mK	R_{thJH}	–	1.19	–	°C/W
PATH IGBT CHARACTERISTICS (T31, T32)						
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	200	µA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 100 A, T_J = 25°C	$V_{CE(sat)}$	–	1.26	2.1	V
	V_{GE} = 15 V, I_C = 100 A, T_J = 150°C		–	1.34	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 100 mA	$V_{GE(TH)}$	3.2	4.6	5.5	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	800	nA
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	20937	–	pF
Output Capacitance		C_{oes}	–	341	–	
Reverse Transfer Capacitance		C_{res}	–	158	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 100 A, V_{GE} = 15 V	Q_g	–	1746	–	nC
Thermal Resistance – chip−to−case		R_{thJC}	–	0.33	–	°C/W
Thermal Resistance – chip−to−heatsink	Thermal grease, Thickness ≈ 57 µm, λ = 2.87 W/mK	R_{thJH}	–	0.64	–	°C/W

Table 3. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
PATH IGBT INVERSE DIODE CHARACTERISTICS (D31, D32)						
Diode Forward Voltage	I_F = 40 A, T_J = 25°C	V_F	–	2.3	3	V
	I_F = 40 A, T_J = 150°C		–	1.6	–	
Thermal Resistance − chip−to−case		R_{thJC}	–	0.6	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK	R_{thJH}	–	0.9	–	°C/W
BOOST DIODE CHARACTERISTICS (D41, D51, D42, D52)						
Diode Reverse Leakage Current	V_R = 1200 V, T_J = 25°C	I_R	–	–	400	μA
Diode Forward Voltage	I_F = 40 A, T_J = 25°C	V_F	–	1.5	2	V
	I_F = 40 A, T_J = 150°C		–	2.0	–	
Peak Reverse Recovery Current	T_J = 25°C V_{CE} = 600 V, I_C = 30 A V_{GE} = −5 V ~ 15V, R_G = 10 Ω	I_{RRM}	–	10	–	A
Reverse Recovery Energy		E_{rr}	–	66	–	μJ
Peak Reverse Recovery Current	T_J = 125°C V_{CE} = 600 V, I_C = 30 A V_{GE} = −5 V ~ 15V, R_G = 10 Ω	I_{RRM}	–	9.9	–	A
Reverse Recovery Energy		E_{rr}	–	64	–	μJ
Thermal Resistance − chip−to−case		R_{thJC}	–	0.59	–	°C/W
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK	R_{thJH}	–	0.97	–	°C/W

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.

Table 4. THERMISTOR CHARACTERISTICS

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Nominal resistance		R_{25}	–	22	–	kΩ
Nominal resistance	T = 100°C	R_{100}	–	1486	–	Ω
Deviation of R25		−R/R	−5	–	5	%
Power dissipation		P_D	–	200	–	mW
Power dissipation constant			–	2	–	mW/K
B−value	B(25/50), tolerance ±3%		–	3950	–	K
B−value	B(25/100), tolerance ±3%		–	3998	–	K

Table 5. ORDERING INFORMATION

Orderable Part Number	Marking	Package	Shipping
NXH200B100H4F2SG, NXH200B100H4F2SG−R	NXH200B100H4F2SG, NXH200B100H4F2SG−R	F2 − Case 180CJ (Pb−Free and Halide−Free, Solder Pins)	20 Units / Blister Tray

TYPICAL CHARACTERISTICS – BOOST IGBT & INVERSE DIODE

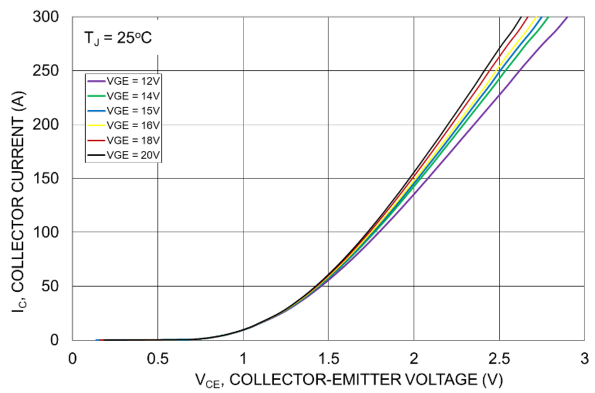


Figure 2. Typical Output Characteristics

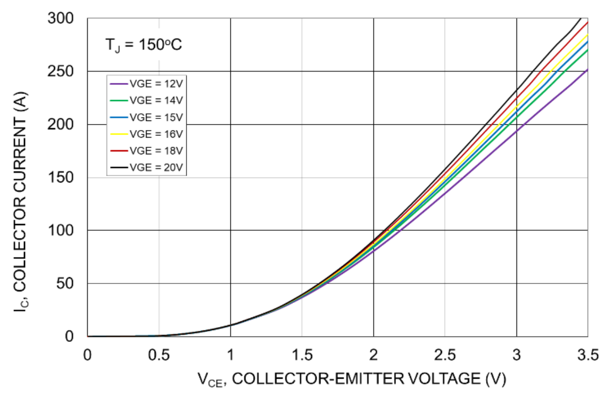


Figure 3. Typical Output Characteristics

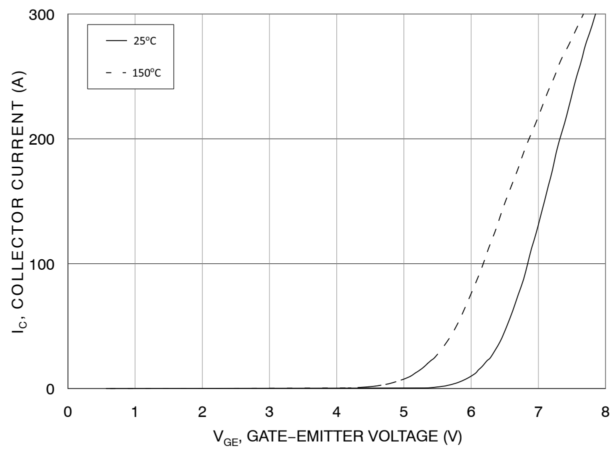


Figure 4. Typical Transfer Characteristics

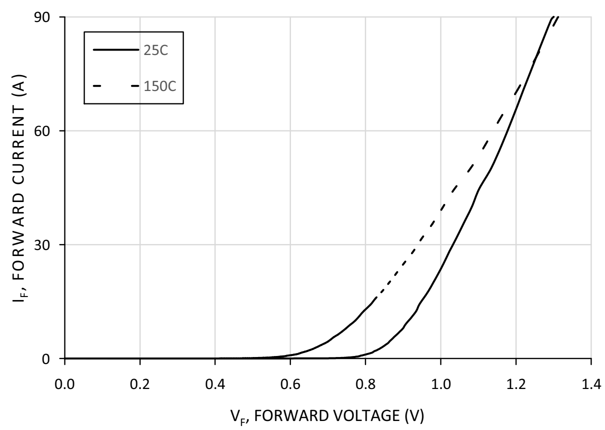


Figure 5. Inverse Diode Forward Characteristics

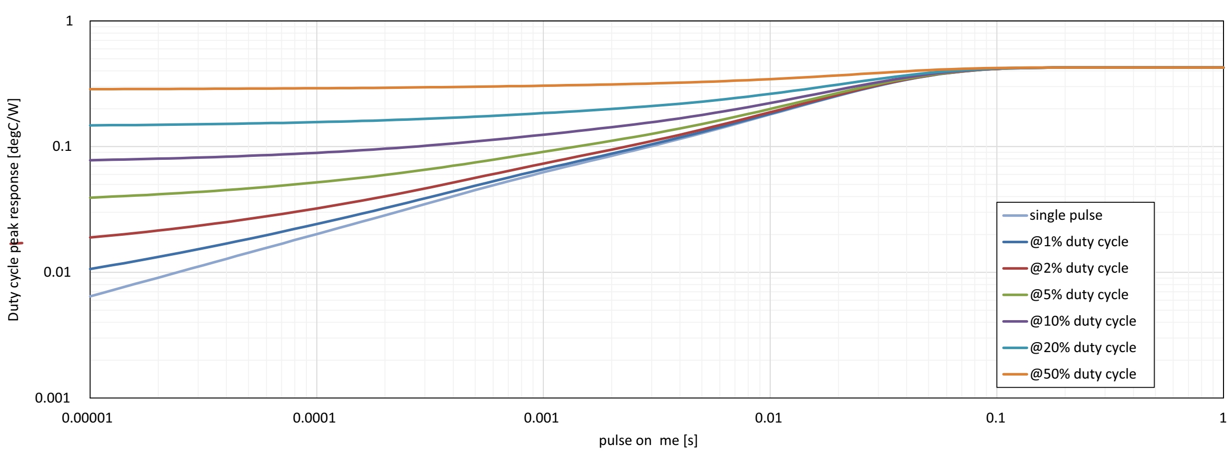


Figure 6. Boost IGBT Transient Thermal Impedance

TYPICAL CHARACTERISTICS – BOOST IGBT & INVERSE DIODE

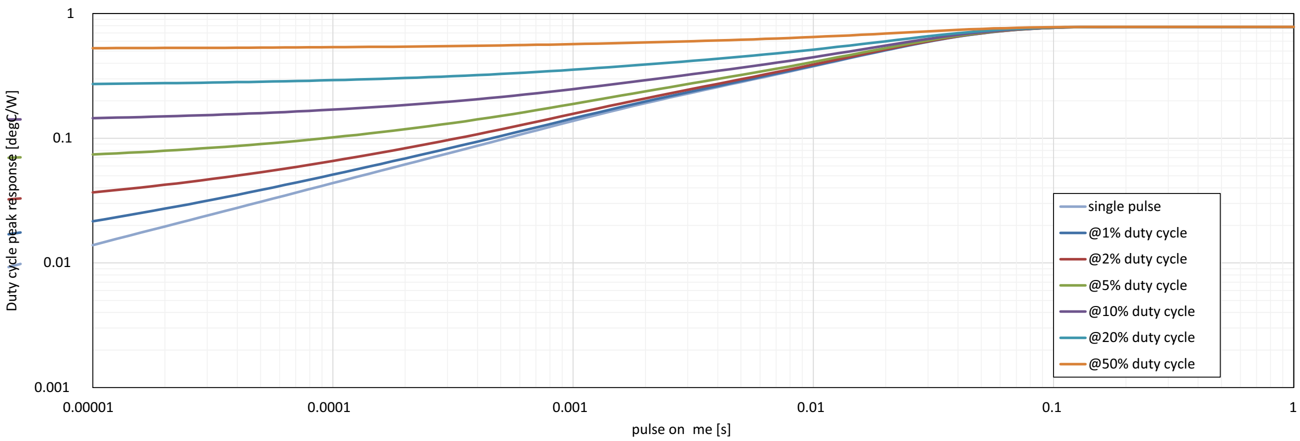


Figure 7. Inverse Diode Transient Thermal Impedance

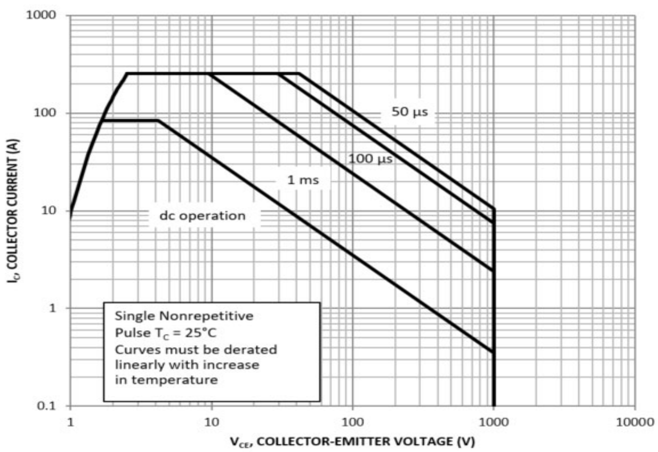


Figure 8. Boost IGBT FBSOA

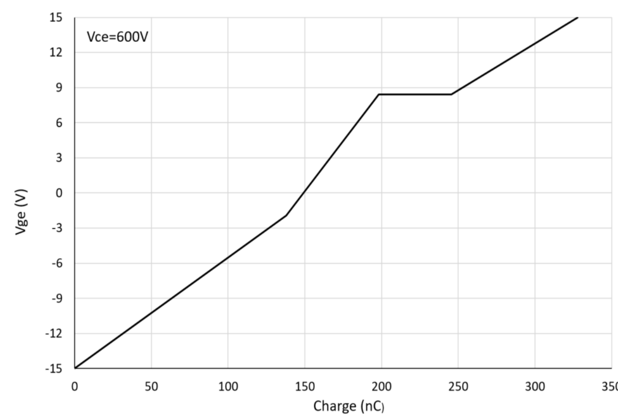


Figure 9. Boost IGBT Gate Voltage vs. Gate Charge

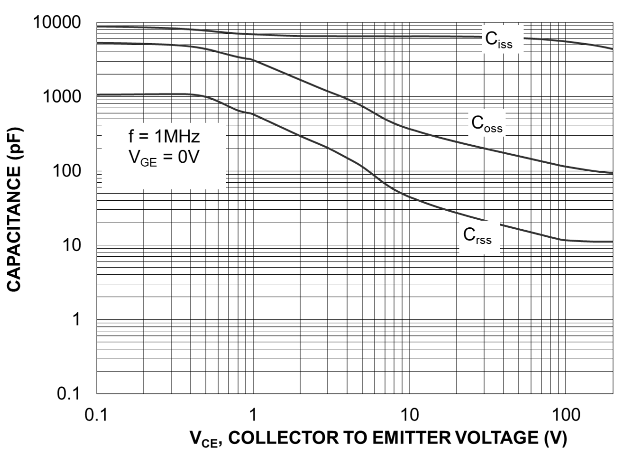


Figure 10. Boost IGBT Capacitance

TYPICAL CHARACTERISTICS – PATH IGBT & INVERSE DIODE

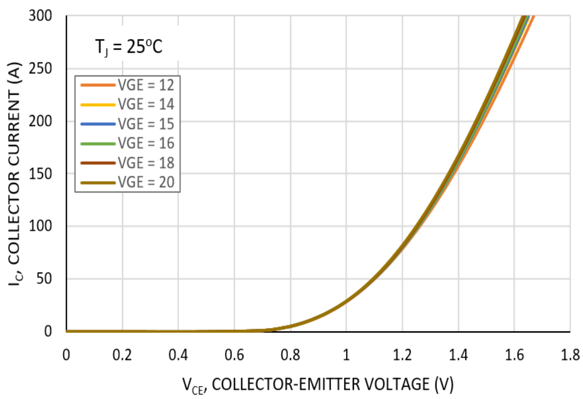


Figure 11. Typical Output Characteristics

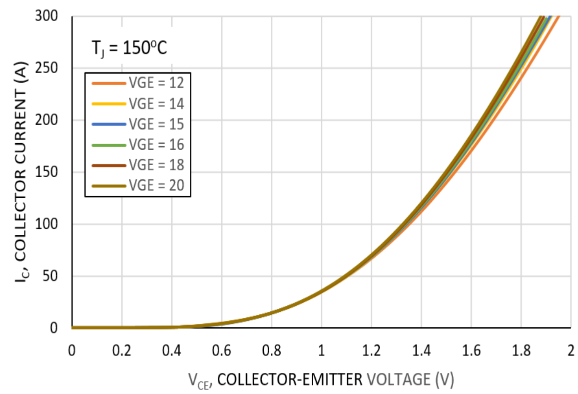


Figure 12. Typical Output Characteristics

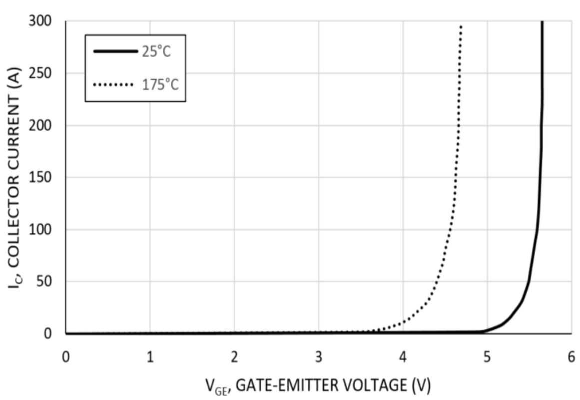


Figure 13. Typical Transfer Characteristics

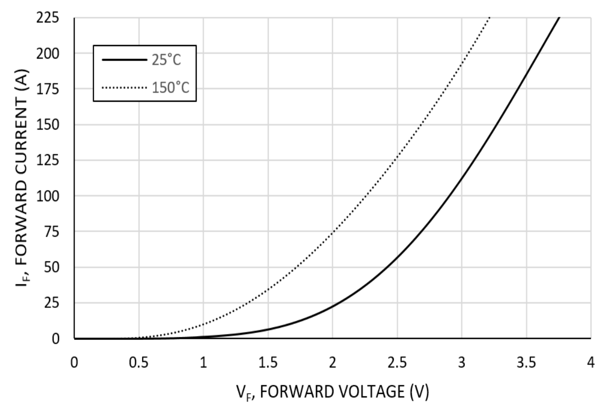


Figure 14. Inverse Diode Forward Characteristics

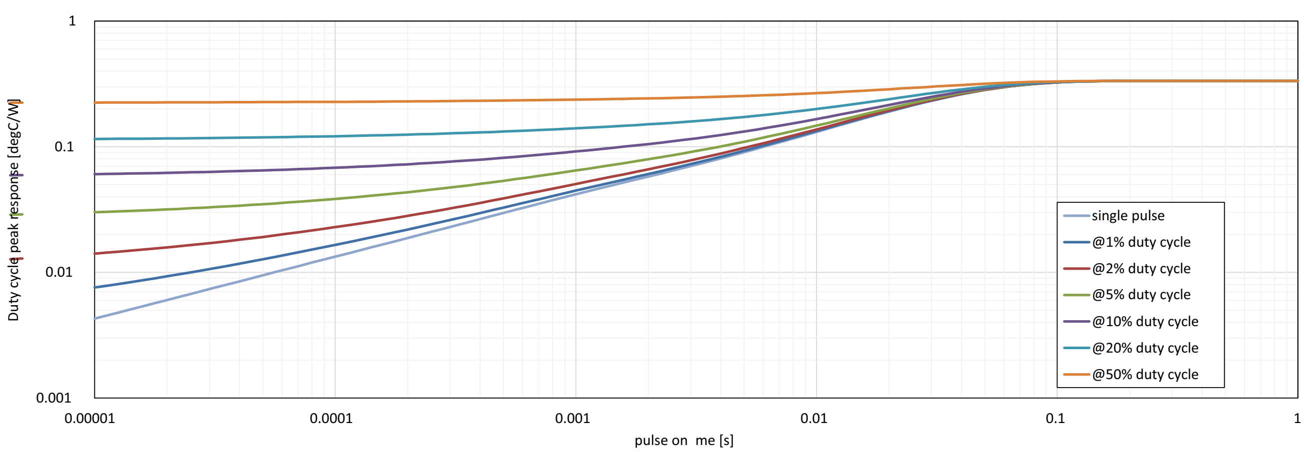


Figure 15. Path IGBT Transient Thermal Impedance

TYPICAL CHARACTERISTICS – PATH IGBT & INVERSE DIODE

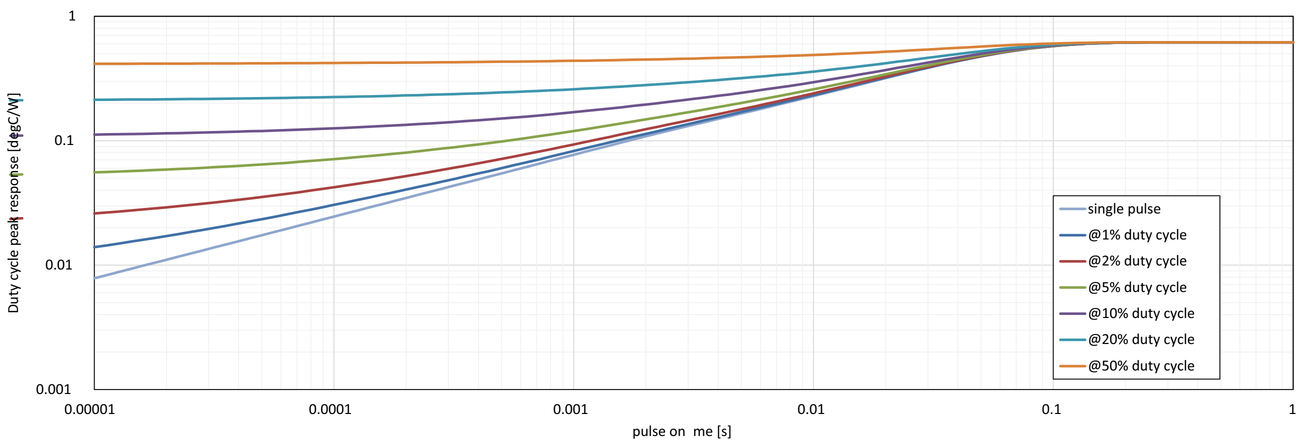


Figure 16. Inverse Diode Transient Thermal Impedance

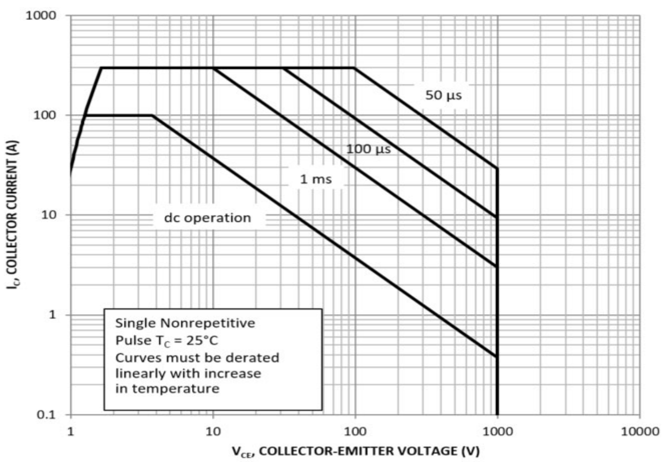


Figure 17. Path IGBT FBSOA

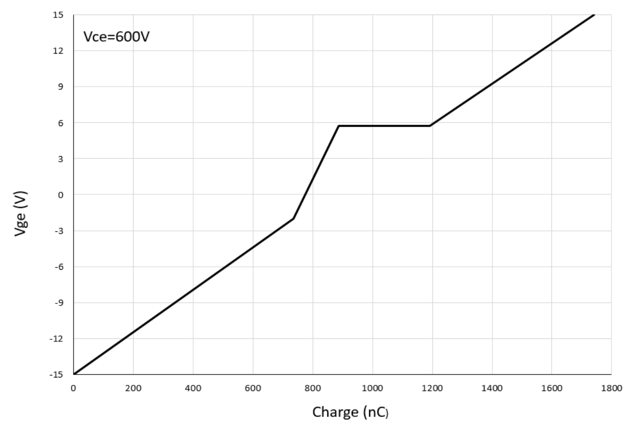


Figure 18. Path IGBT Gate Voltage vs. Gate Charge

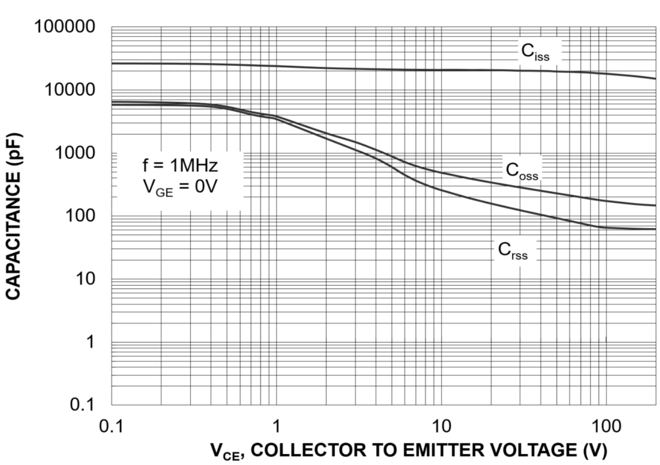


Figure 19. Path IGBT Capacitance

TYPICAL CHARACTERISTICS – BOOST DIODE

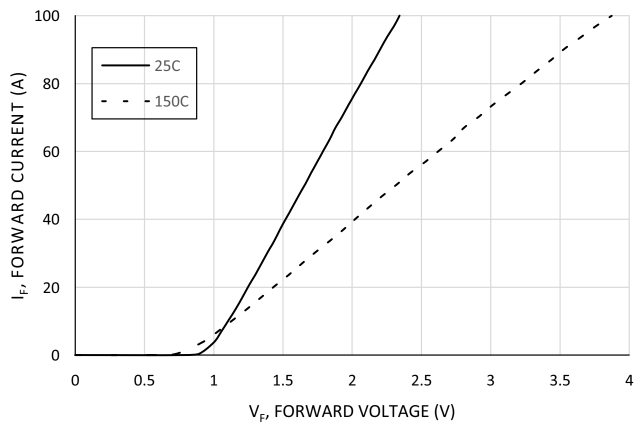


Figure 20. Typical Forward Characteristics

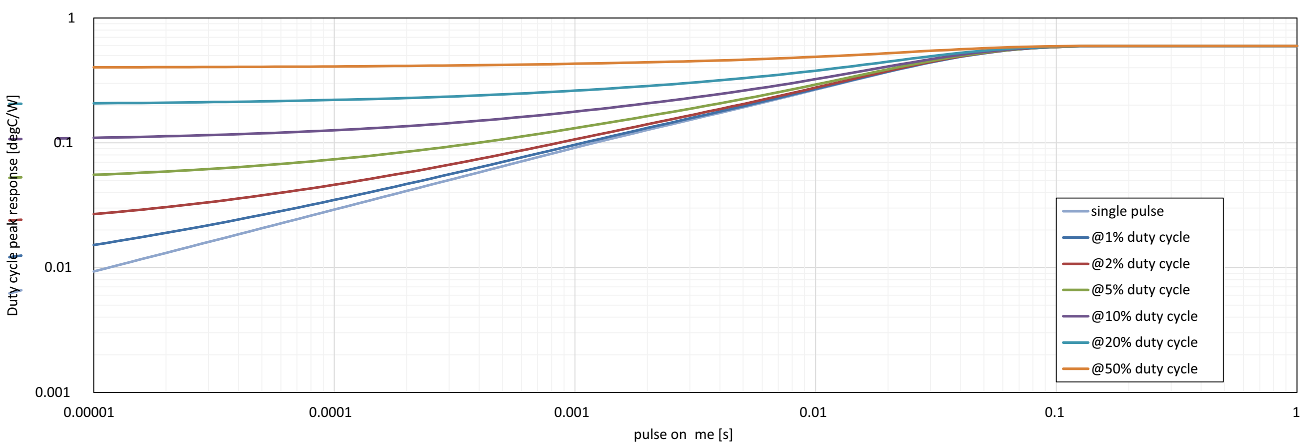


Figure 21. Junction−to−Case Transient Thermal Impedance

TYPICAL CHARACTERISTICS – BOOST IGBT COMMUTATE BOOST DIODE

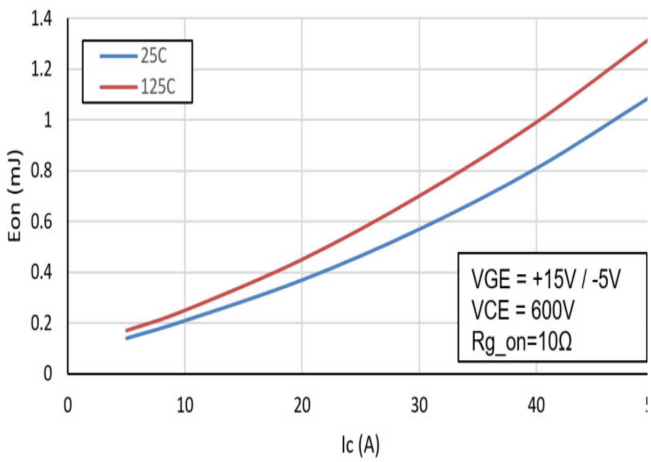


Figure 22. Typical Turn On Loss vs. I_C

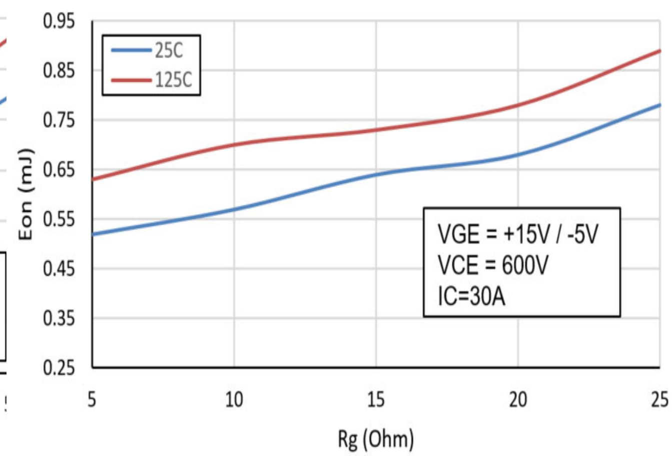


Figure 23. Typical Turn On Loss vs. R_G

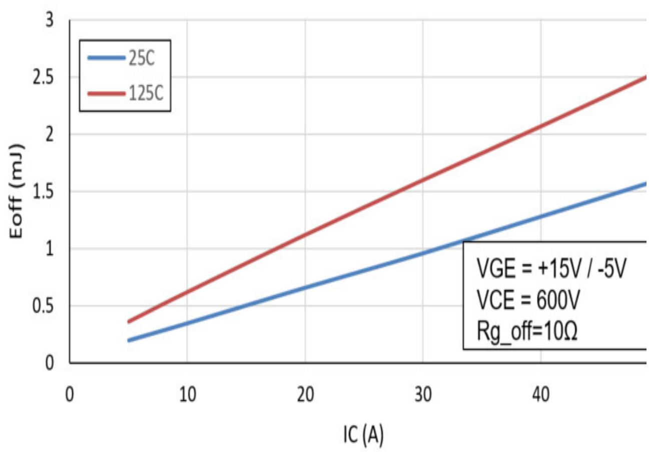


Figure 24. Typical Turn Off Loss vs. I_C

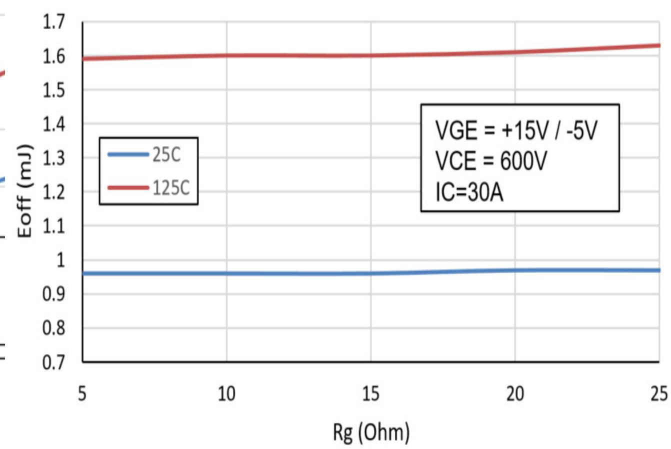


Figure 25. Typical Turn Off Loss vs. R_G

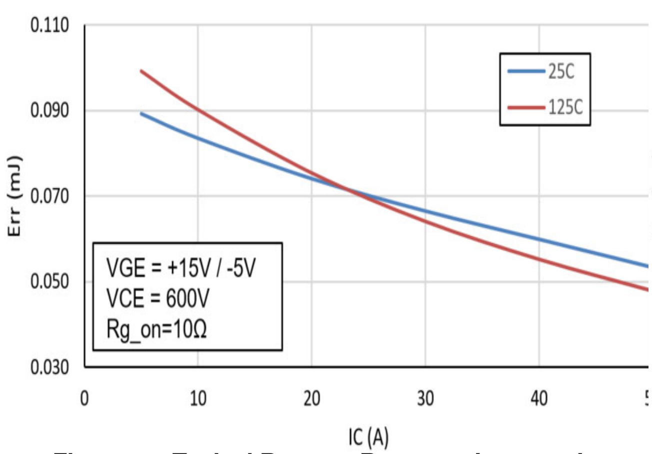


Figure 26. Typical Reverse Recovery Loss vs. I_C

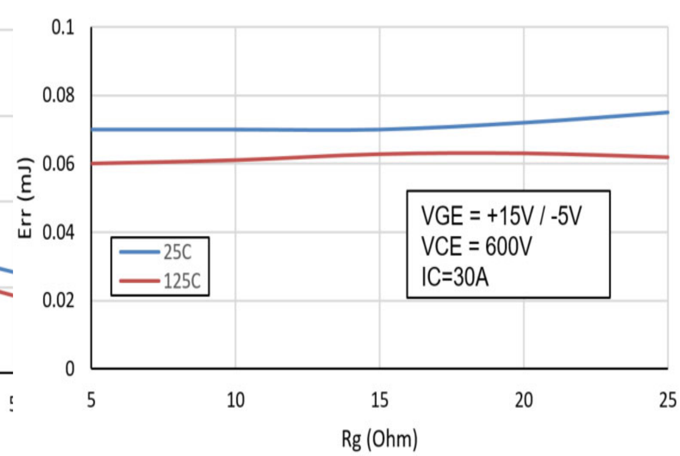


Figure 27. Typical Reverse Recovery Loss vs. R_G

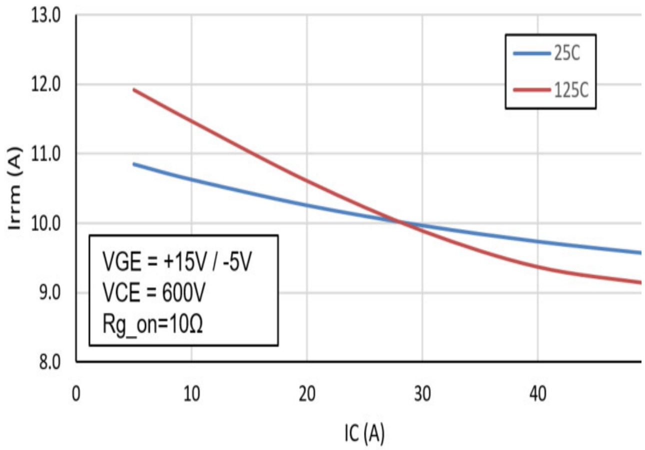


Figure 28. Typical Reverse Recovery Current vs. I_C

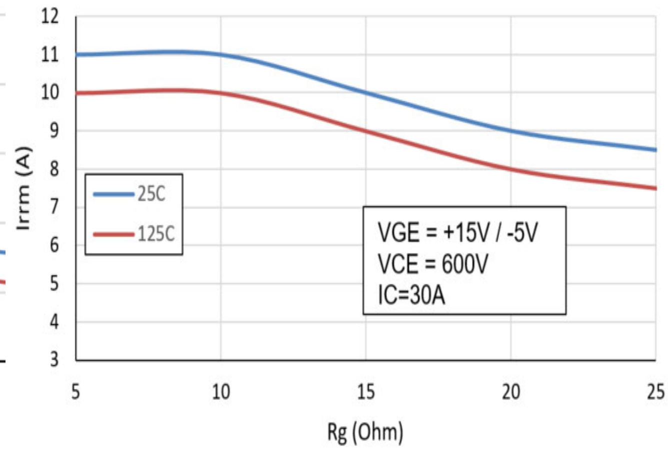


Figure 29. Typical Reverse Recovery Current vs. R_G

TYPICAL CHARACTERISTICS – THERMISTOR

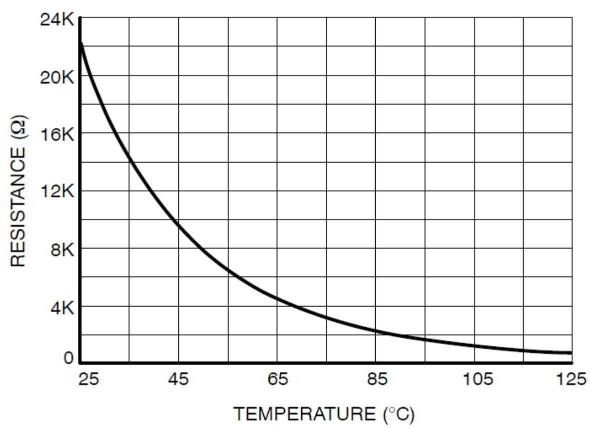
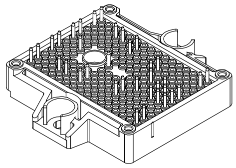
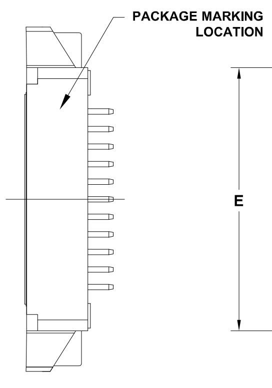


Figure 30. Thermistor Characteristics

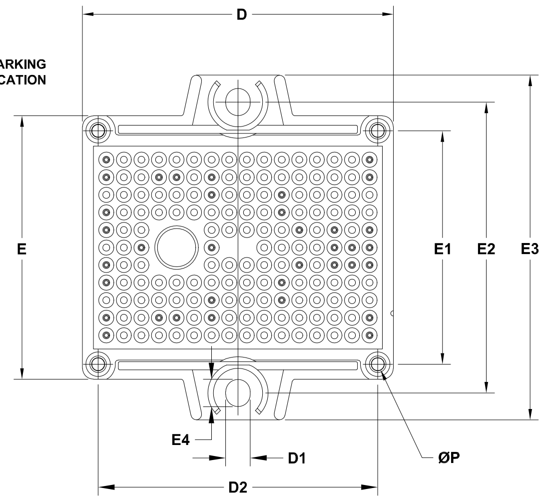


PIM36 56.7x42.5 (SOLDER PIN)
CASE 180CJ
ISSUE C

DATE 18 MAY 2023



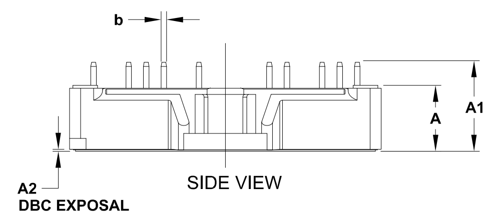
END VIEW



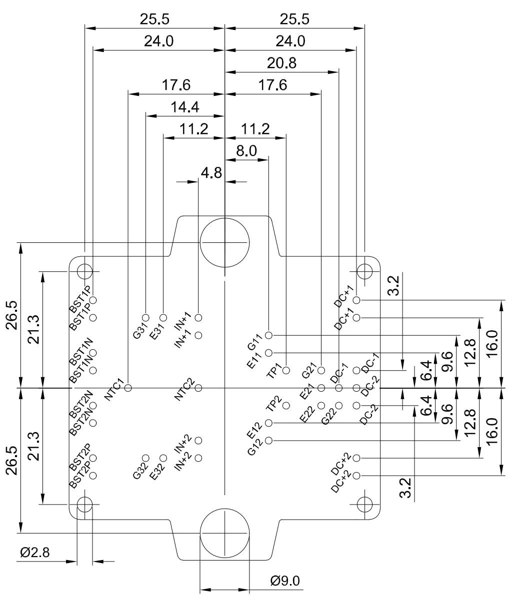
TOP VIEW

NOTES:
1. CONTROLLING DIMENSION: MILLIMETERS
2. PIN POSITION TOLERANCE IS ± 0.4mm

DIM	MILLIMETERS MIN.	NOM.	MAX.
A	11.65	12.00	12.35
A1	15.65	16.15	16.65
A2	0.00	0.35	0.60
b	0.95	1.00	1.05
D	56.40	56.70	57.00
D1	4.40	4.50	4.60
D2	50.85	51.00	51.15
E	47.70	48.00	48.30
E1	42.35	42.50	42.65
E2	52.90	53.00	53.10
E3	62.30	62.80	63.30
E4	4.90	5.00	5.10
P	2.20	2.30	2.40



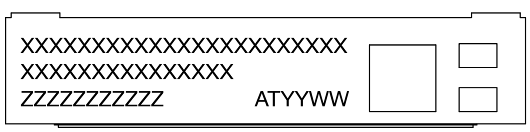
SIDE VIEW



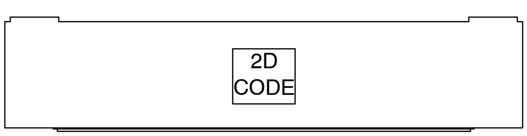
RECOMMENDED MOUNTING PATTERN

* For additional Information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDER RM/D.

GENERIC MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

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

*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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DESCRIPTION:	PIM36 56.7x42.5 (SOLDER PIN)	PAGE 1 OF 1

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