

# 3-Level NPC Inverter Module

# **Product Preview**

# NXH600N105L7F5SHG

The NXH600N105L7F5SHG is a power module in F5BP package containing an I-type neutral point clamped three-level inverter. The integrated field stop trench IGBTs and FRDs provide lower conduction and switching losses, enabling designers to achieve high efficiency, high power density and superior reliability.

#### **Features**

- I-type Neutral Point Clamped Three-level Inverter Module
- 1050 V Field Stop 7 IGBTs
- Low Inductive Layout
- Solder Pins
- Integrated NTC Thermistor
- This is a Pb-Free and Halide Free Device

#### **Typical Applications**

- Energy Storage System
- Solar Inverters

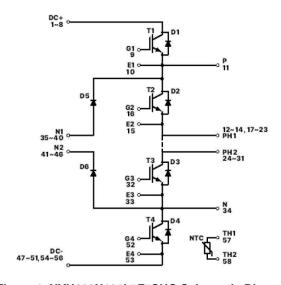
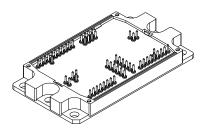


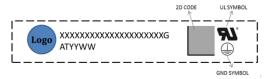
Figure 1. NXH600N105L7F5SHG Schematic Diagram

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



PIM58 112x62 (SOLDER PIN) CASE 180HX

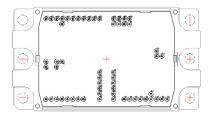
#### MARKING DIAGRAM



XXXXX = Device Code G = Pb-Free Package

AT = Assembly & Test Site Code YYWW = Year and Work Week Code

#### **PIN CONNECTIONS**



#### **ORDERING INFORMATION**

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

# **MODULE CHARACTERISTICS**

Parameter	Symbol	Value	Unit
Operating Temperature under Switching Condition	T <sub>VJOP</sub>	-40 to 150	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to 125	°C
Isolation Test Voltage, t = 2 sec, 50 Hz (Note 1)	V <sub>is</sub>	4800	V <sub>RMS</sub>
Stray Inductance	L <sub>s CE</sub>	15	nH
Terminal Connection Torque (M5, Screw)	M	3 to 5	Nm
Weight	G	245	g
Creepage Distance (terminal to heatsink)		17.46	mm
Creepage Distance (terminal to terminal)		6.48	mm
Clearance Distance (terminal to heatsink)		15.62	mm
Clearance Distance (terminal to terminal)		5.05	mm
Comparative Tracking Index	CTI	>600	

<sup>1. 4800</sup> VAC  $_{\mbox{\scriptsize RMS}}$  for 2 second duration is equivalent to 4000 VAC  $_{\mbox{\scriptsize RMS}}$  for 1 minute duration.

# **MAXIMUM RATINGS** ( $T_J = 25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Max	Unit
OUTER IGBT (T1, T4)			•
Collector-Emitter Voltage	V <sub>CES</sub>	1050	V
Gate-Emitter Voltage Positive Transient Gate-emitter Voltage ( $T_{pulse}$ = 5 $\mu$ s, D < 0.10)	V <sub>GE</sub>	±20 30	V
Continuous Collector Current @ T <sub>C</sub> = 80°C (T <sub>J</sub> = 175°C)	I <sub>C</sub>	429	А
Pulsed Peak Collector Current @ T <sub>C</sub> = 80°C (T <sub>J</sub> = 175°C) @ T <sub>pulse</sub> = 1 ms	I <sub>C(Pulse)</sub>	1287	А
Power Dissipation (T <sub>J</sub> = 175°C, T <sub>c</sub> = 80°C)	P <sub>tot</sub>	1080	W
Minimum Operating Junction Temperature	T <sub>JMIN</sub>	-40	°C
Maximum Operating Junction Temperature	T <sub>JMAX</sub>	175	°C
INNER IGBT (T2, T3)			
Collector-Emitter Voltage	V <sub>CES</sub>	1050	V
Gate-Emitter Voltage Positive Transient Gate-emitter Voltage ( $T_{pulse}$ = 5 $\mu$ s, D < 0.10)	V <sub>GE</sub>	±20 30	V
Continuous Collector Current @ T <sub>C</sub> = 80°C (T <sub>J</sub> = 175°C)	I <sub>C</sub>	429	А
Pulsed Peak Collector Current @ T <sub>C</sub> = 80°C (T <sub>J</sub> = 175°C) @ T <sub>pulse</sub> = 1 ms	I <sub>C(Pulse)</sub>	1287	А
Power Dissipation (T <sub>J</sub> = 175°C, T <sub>c</sub> = 80°C)	P <sub>tot</sub>	1080	W
Minimum Operating Junction Temperature	T <sub>JMIN</sub>	-40	°C
Maximum Operating Junction Temperature	T <sub>JMAX</sub>	175	°C
NEUTRAL POINT DIODE (D5, D6)			
Peak Repetitive Reverse Voltage	V <sub>RRM</sub>	1050	V
Continuous Forward Current @ T <sub>c</sub> = 80°C	I <sub>F</sub>	233	А
Repetitive Peak Forward Current (T <sub>J</sub> = 175°C) T <sub>pulse</sub> = 1 ms	I <sub>FRM</sub>	699	Α
Maximum Power Dissipation @ T <sub>c</sub> = 80°C (T <sub>J</sub> = 175°C)	P <sub>tot</sub>	621	W
Minimum Operating Junction Temperature	T <sub>JMIN</sub>	-40	°C
Maximum Operating Junction Temperature	T <sub>JMAX</sub>	175	°C
INVERSE DIODES (D1, D2, D3, D4)			
Peak Repetitive Reverse Voltage	V <sub>RRM</sub>	1050	V
Continuous Forward Current @ T <sub>c</sub> = 80°C	I <sub>F</sub>	170	А

# **MAXIMUM RATINGS** ( $T_J = 25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Max	Unit
INVERSE DIODES (D1, D2, D3, D4)			
Repetitive Peak Forward Current (T <sub>J</sub> = 175°C) @ T <sub>pulse</sub> = 1 ms	I <sub>FRM</sub>	510	Α
Maximum Power Dissipation @ T <sub>c</sub> = 80°C (T <sub>J</sub> = 175°C)	P <sub>tot</sub>	434	W
Minimum Operating Junction Temperature	T <sub>JMIN</sub>	-40	°C
Maximum Operating Junction Temperature	T <sub>JMAX</sub>	175	°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.

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

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

Parameter	Test Condition	Symbol	Min	Тур	Max	Unit
OUTER IGBT (T1, T4)						
Collector-Emitter Cutoff Current	$V_{GE} = 0 \text{ V}, V_{CE} = 1050 \text{ V}$	I <sub>CES</sub>	-	-	500	μΑ
Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 600 A, T <sub>J</sub> = 25°C	V <sub>CE(SAT)</sub>	-	1.6	2.3	V
	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 600 A, T <sub>J</sub> = 150°C		-	2.0	_	
Gate-Emitter Threshold Voltage	$V_{GE} = V_{CE}$ , $I_C = 600$ mA	V <sub>GE(TH)</sub>	4.0	5.5	6.9	V
Gate Leakage Current	$V_{GE} = 20 \text{ V}, V_{CE} = 0 \text{ V}$	I <sub>GES</sub>	-	-	1	μΑ
Internal Gate Resistor		R <sub>g</sub>	-	0.58	-	Ω
Turn-off safe operating area	$V_{CC}$ < 800 V, $R_{G,off} \ge 30 \Omega$ , $T_{vj}$ < 150°C		-	800	-	Α
Turn-on Delay Time	T <sub>J</sub> = 25°C	t <sub>d(on)</sub>	-	219	-	ns
Rise Time	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 7 Ω,	t <sub>r</sub>	-	52	-	
Turn-off Delay Time	$R_{G,off} = 17 \Omega$	t <sub>d(off)</sub>	-	1141	-	
Fall Time		t <sub>f</sub>	-	38	_	
Turn-on Switching Loss per Pulse		E <sub>on</sub>	-	8390	-	μJ
Turn off Switching Loss per Pulse		E <sub>off</sub>	-	9270	-	
Turn-on Delay Time	T <sub>J</sub> = 125°C	t <sub>d(on)</sub>	-	196	-	ns
Rise Time	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 7 Ω,	t <sub>r</sub>	-	58	-	
Turn-off Delay Time	$R_{G,off} = 17 \Omega$	t <sub>d(off)</sub>	-	1126	-	
Fall Time		t <sub>f</sub>	-	43	-	
Turn-on Switching Loss per Pulse		E <sub>on</sub>	-	13750	-	μЈ
Turn off Switching Loss per Pulse		E <sub>off</sub>	-	11840	-	
Input Capacitance	$V_{CE} = 20 \text{ V. } V_{GE} = 0 \text{ V. } f = 100 \text{ kHz}$	C <sub>ies</sub>	-	48597	-	pF
Output Capacitance		C <sub>oes</sub>	-	1836.2	-	
Reverse Transfer Capacitance		C <sub>res</sub>	-	276.9	-	
Total Gate Charge	$V_{CE} = 600 \text{ V}, V_{GE} = -15/+20 \text{ V}, I_{C} = 57 \text{ A}$	Qg	-	3048	-	nC
Thermal Resistance - Chip-to-heatsink	Thermal grease,	$R_{thJH}$	-	0.139	-	°C/W
Thermal Resistance - Chip-to-case	Thickness = 2.1 Mil $\pm$ 2%, $\lambda$ = 2.9 W/mK	R <sub>thJC</sub>	-	0.088	_	°C/W
NEUTRAL POINT DIODE (D5, D6)						
Diode Forward Voltage	I <sub>F</sub> = 400 A, T <sub>J</sub> = 25°C	V <sub>F</sub>	-	2.7	3.4	V
	I <sub>F</sub> = 400 A, T <sub>J</sub> = 150°C		-	2.4	-	1
Surge Forward Current	t <sub>p</sub> = 10 ms, T <sub>vj</sub> = 150°C	I <sub>FSM</sub>	-	1800	_	Α
I <sup>2</sup> t	t <sub>p</sub> = 10 ms, T <sub>vi</sub> = 150°C	l <sup>2</sup> t	_	16200	_	A <sup>2</sup> s

Operating parameters.

# **ELECTRICAL CHARACTERISTICS** ( $T_J = 25^{\circ}C$ unless otherwise noted)

Parameter	Test Condition	Symbol	Min	Тур	Max	Unit
Reverse Leakage Current	V <sub>F</sub> = 1050 V, T <sub>J</sub> = 25°C	I <sub>R</sub>	_	-	200	μΑ
Reverse Recovery Time	T <sub>J</sub> = 25°C	t <sub>rr</sub>	_	95	_	ns
Reverse Recovery Charge	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 7 $\Omega$	Q <sub>rr</sub>	_	5.25	_	μC
Peak Reverse Recovery Current	ŕ	I <sub>RRM</sub>	_	121	_	Α
Peak Rate of Fall of Recovery Current		di/dt	-	3.08	_	A/μs
Reverse Recovery Energy		E <sub>rr</sub>	_	1724	_	μЈ
Reverse Recovery Time	T <sub>J</sub> = 125°C	t <sub>rr</sub>	_	178	_	ns
Reverse Recovery Charge	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 7 Ω	Q <sub>rr</sub>	_	19.3	_	μC
Peak Reverse Recovery Current	ŕ	I <sub>RRM</sub>	_	215	_	Α
Peak Rate of Fall of Recovery Current		di/dt	_	2.87	_	A/μs
Reverse Recovery Energy		E <sub>rr</sub>	_	7229	_	μЈ
Thermal Resistance - Chip-to-heatsink	Thermal grease,	R <sub>thJH</sub>	_	0.236	_	°C/W
Thermal Resistance - Chip-to-case	Thickness = 2.1 Mil $\pm$ 2%, $\lambda$ = 2.9 W/mK	R <sub>thJC</sub>	_	0.150	_	°C/W
INNER IGBT (T2, T3)			ı		ı	
Collector-Emitter Cutoff Current	$V_{GE} = 0 \text{ V}, V_{CE} = 1050 \text{ V}$	I <sub>CES</sub>	-	_	500	μΑ
Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 600 A, T <sub>J</sub> = 25°C	V <sub>CE(sat)</sub>	_	1.6	2.3	V
	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 600 A, T <sub>J</sub> = 150°C		_	2.0	_	1
Gate-Emitter Threshold Voltage	$V_{GE} = V_{CE}$ , $I_C = 600 \text{ mA}$	V <sub>GE(TH)</sub>	4.0	5.5	6.9	V
Gate Leakage Current	$V_{GE} = 20 \text{ V}, V_{CE} = 0 \text{ V}$	I <sub>GES</sub>	_	-	1	μΑ
Internal Gate Resistor		$R_g$	_	0.58	_	Ω
Turn-off safe operating area	$V_{CC} < 800 \text{ V},$ $R_{G, \text{off}} \ge 30 \Omega, T_{vj} < 150^{\circ}\text{C}$		-	800	-	Α
Turn-on Delay Time	T <sub>J</sub> = 25°C	t <sub>d(on)</sub>	-	175	-	ns
Rise Time	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 5 Ω,	t <sub>r</sub>	_	44	_	1
Turn-off Delay Time	$R_{G,off} = 24 \Omega$	t <sub>d(off)</sub>	_	1674	_	1
Fall Time		t <sub>f</sub>	_	43	_	1
Turn-on Switching Loss per Pulse		E <sub>on</sub>	-	5890	-	μJ
Turn off Switching Loss per Pulse		E <sub>off</sub>	-	11110	-	1
Turn-on Delay Time	T <sub>J</sub> = 125°C	t <sub>d(on)</sub>	-	163	-	ns
Rise Time	$V_{CE}$ = 600 V, $I_{C}$ = 200 A $V_{GE}$ = -9 V to +15 V, $R_{G,on}$ = 5 Ω,	t <sub>r</sub>	-	44	-	1
Turn-off Delay Time	$R_{G,off} = 24 \Omega$	t <sub>d(off)</sub>	_	1818	_	1
Fall Time		t <sub>f</sub>	_	23	_	1
Turn-on Switching Loss per Pulse		E <sub>on</sub>	_	8720	_	μJ
Turn off Switching Loss per Pulse		E <sub>off</sub>	_	13490	_	1
Input Capacitance	V <sub>CE</sub> = 20 V. V <sub>GE</sub> = 0 V. f = 100 kHz	C <sub>ies</sub>	-	48597	-	pF
Output Capacitance		C <sub>oes</sub>	_	1836	_	1
Reverse Transfer Capacitance		C <sub>res</sub>	_	277	_	1
Total Gate Charge	$V_{CE} = 600 \text{ V}, I_{C} = 57 \text{ A}, V_{GE} = -15/+20 \text{ V}$	Qg	-	3048	-	nC
Thermal Resistance - Chip-to-heatsink	Thermal grease,	R <sub>thJH</sub>	-	0.139	-	°C/W
Thermal Resistance - Chip-to-case	Thickness = 2.1 Mil $\pm 2\%$ , $\lambda$ = 2.9 W/mK	R <sub>thJC</sub>	_	0.088	_	°C/W

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

Parameter	arameter Test Condition		Min	Тур	Max	Unit
INVERSE DIODES (D1, D2, D3, D4)		•	•	•		•
Diode Forward Voltage	I <sub>F</sub> = 300 A, T <sub>J</sub> = 25°C	V <sub>F</sub>	_	2.7	3.4	V
	I <sub>F</sub> = 300 A, T <sub>J</sub> = 150°C	1	_	2.3	-	
Surge Forward Current	$t_p = 10 \text{ ms, } T_{vj} = 150^{\circ}\text{C}$	I <sub>FSM</sub>	-	1500	-	Α
l <sup>2</sup> t	$t_p = 10 \text{ ms, } T_{vj} = 150^{\circ}\text{C}$	I <sup>2</sup> t	_	11250	_	A <sup>2</sup> s
Reverse Recovery Time	T <sub>J</sub> = 25°C	t <sub>rr</sub>	-	85	-	ns
Reverse Recovery Charge	$V_{CE} = 600 \text{ V}, I_{C} = 200 \text{ A}$ $V_{GE} = -9 \text{ V to } +15 \text{ V}, R_{G,on} = 5 \Omega$	Q <sub>rr</sub>	-	5.65	-	nC
Peak Reverse Recovery Current	,	I <sub>RRM</sub>	-	148	-	Α
Peak Rate of Fall of Recovery Current		di/dt	-	3.69	-	A/μs
Reverse Recovery Energy		E <sub>rr</sub>	-	2283	-	μJ
Reverse Recovery Time	T <sub>J</sub> = 125°C	t <sub>rr</sub>	-	183	-	ns
Reverse Recovery Charge	$V_{CE} = 600 \text{ V}, I_{C} = 200 \text{ A}$ $V_{GE} = -9 \text{ V to } +15 \text{ V}, R_{G,on} = 5 \Omega$	Q <sub>rr</sub>	-	18	-	nC
Peak Reverse Recovery Current		I <sub>RRM</sub>	-	224	-	Α
Peak Rate of Fall of Recovery Current		di/dt	-	3.80	-	A/μs
Reverse Recovery Energy		E <sub>rr</sub>	-	8250	-	μJ
Thermal Resistance - Chip-to-heatsink	Thermal grease,	$R_{thJH}$	-	0.277	-	°C/W
Thermal Resistance - Chip-to-case	Thickness = 2.1 Mil $\pm 2\%$ , $\lambda$ = 2.9 W/mK	R <sub>thJC</sub>	_	0.220	_	°C/W
THERMISTOR CHARACTERISTICS		•	•	•		•
Nominal Resistance	T = 25°C	R <sub>25</sub>	_	5	_	kΩ
Nominal Resistance	T = 100°C	R <sub>100</sub>	-	492.2	_	Ω
Deviation of R25		R/R	-1	-	1	%
Power Dissipation		$P_{D}$	-	5	_	mW
Power Dissipation Constant			-	1.3	_	mW/K
B-value	B(25/85), tolerance ±1%		-	3430	_	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.

### **ORDERING INFORMATION**

Device Marking		Package	Shipping
NXH600N105L7F5SHG	NXH600N105L7F5SHG	F5 – PIM58 112x62 (Solder PIN) (Pb-Free and Halide-Free, Solder Pins)	8 Units / Blister Tray

# TYPICAL CHARACTERISTICS - T1, T2, T3, T4 (IGBT)

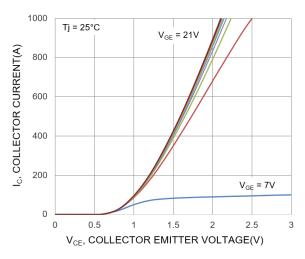


Figure 2. Typical Output Characteristics
– IGBT

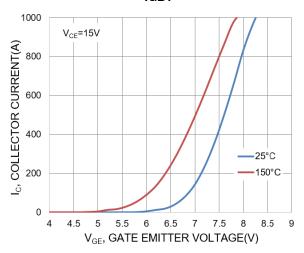


Figure 4. Transfer Characteristics – IGBT

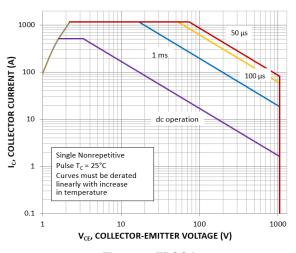


Figure 6. FBSOA

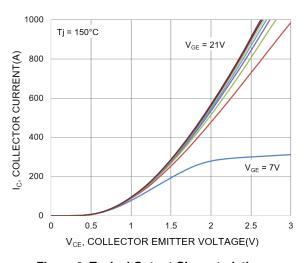


Figure 3. Typical Output Characteristics – IGBT

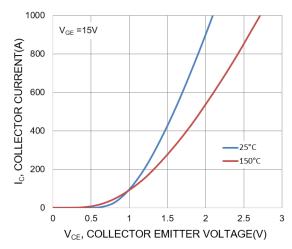


Figure 5. Saturation Voltage Characteristic
- IGBT

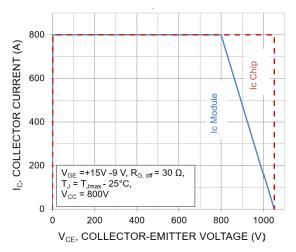
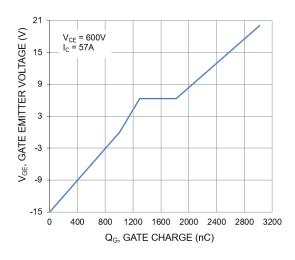


Figure 7. RBSOA (T1-T4)

# TYPICAL CHARACTERISTICS - T1, T2, T3, T4 (IGBT)



100000

10000

10000

10000

1000

C<sub>les</sub>

C<sub>res</sub>

100

C<sub>res</sub>

C<sub>res</sub>

100

C<sub>res</sub>

100

C<sub>res</sub>

100

C<sub>res</sub>

100

C<sub>res</sub>

100

C<sub>res</sub>

100

C<sub>res</sub>

C<sub>res</sub>

100

C<sub>res</sub>

C<sub>res</sub>

100

C<sub>res</sub>

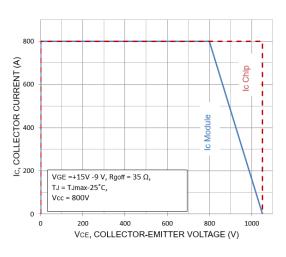
C<sub>res</sub>

100

C<sub>res</sub>

Figure 8. Gate Voltage vs. Gate Charge

Figure 9. Capacitance vs. VCE



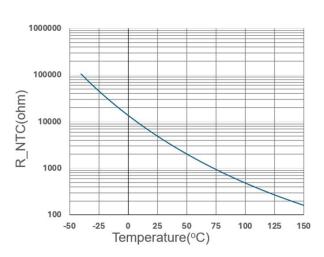


Figure 10. RBSOA (T2-T3)

Figure 11. Temperature vs. NTC Value

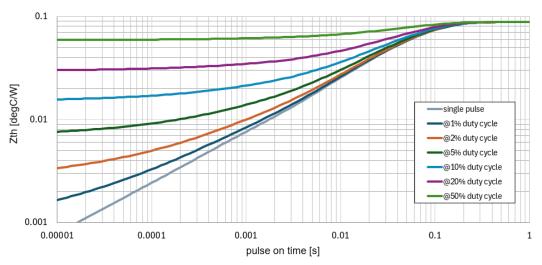


Figure 12. Transient Thermal Impedance (IGBT Zthjc)

# TYPICAL CHARACTERISTICS - D1, D2, D3, D4 (INVERSE DIODE)

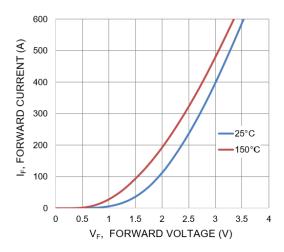


Figure 13. Inverse Diode Forward Characteristics

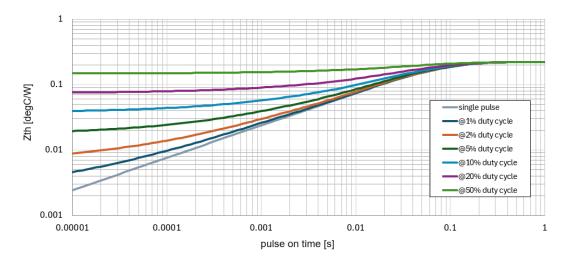


Figure 14. Transient Thermal Impedance (Inverse Diode Zthjc)

# TYPICAL CHARACTERISTICS – D5, D6 (NEUTRAL POINT DIODE)

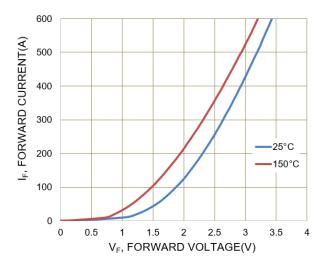


Figure 15. Neutral Diode Forward Characteristics

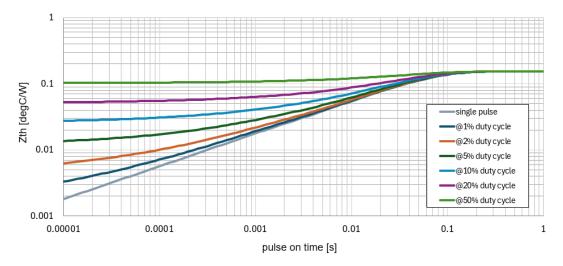


Figure 16. Transient Thermal Impedance (Neutral Point Diode Zthjc)

# TYPICAL CHARACTERISTICS - T1 || D5 OR T4 || D6

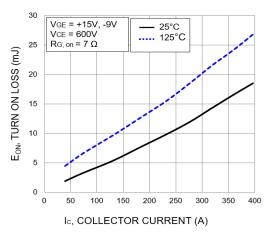


Figure 17. Typical Turn On Loss vs. Ic

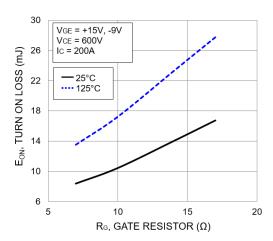


Figure 19. Typical Turn On Loss vs. R<sub>G</sub>

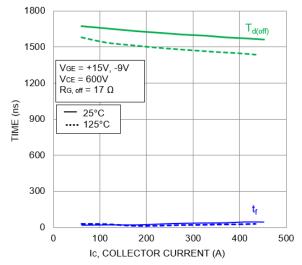


Figure 21. Typical Turn-Off Switching Time vs. Ic

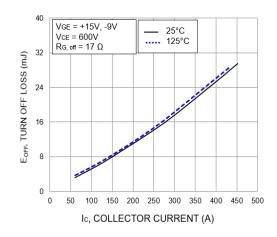


Figure 18. Typical Turn Off Loss vs. lc

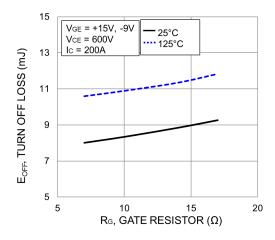


Figure 20. Typical Turn Off Loss vs. R<sub>G</sub>

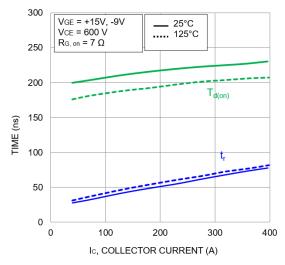


Figure 22. Typical Turn-On Switching Time vs. Ic

# TYPICAL CHARACTERISTICS - T1 || D5 OR T4 || D6

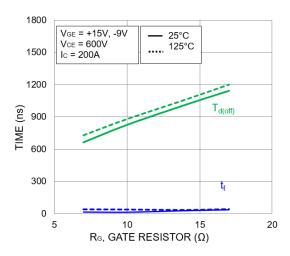


Figure 23. Typical Turn-Off Switching Time vs. R<sub>G</sub>

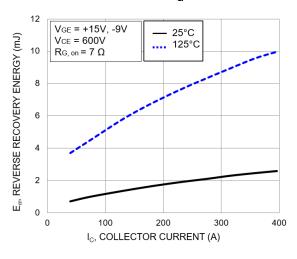


Figure 25. Typical Reverse Recovery Energy Loss vs. Ic

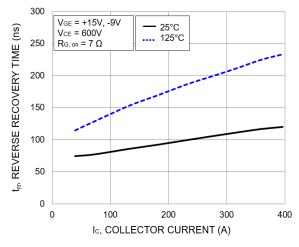


Figure 27. Typical Reverse Recovery
Time vs. lc

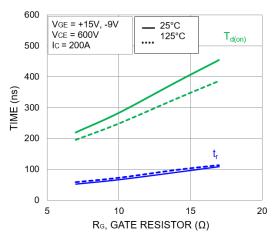


Figure 24. Typical Turn-On Switching Time vs. R<sub>G</sub>

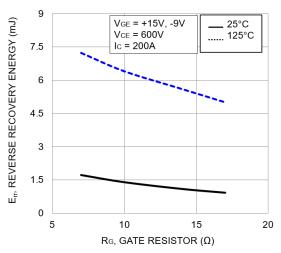


Figure 26. Typical Reverse Recovery Energy Loss vs. R<sub>G</sub>

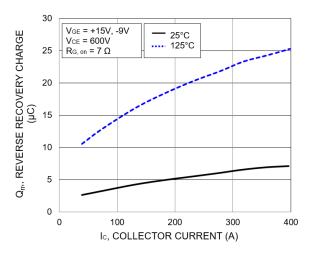


Figure 28. Typical Reverse Recovery Charge vs. Ic

# TYPICAL CHARACTERISTICS - T1 || D5 OR T4 || D6

6

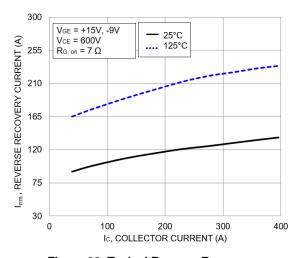


Figure 29. Typical Reverse Recovery Current vs. Ic

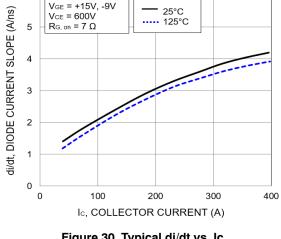


Figure 30. Typical di/dt vs. lc

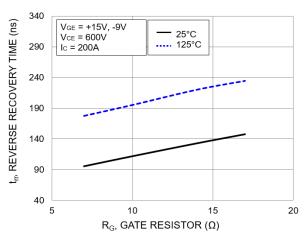


Figure 31. Typical Reverse Recovery Time vs. R<sub>G</sub>

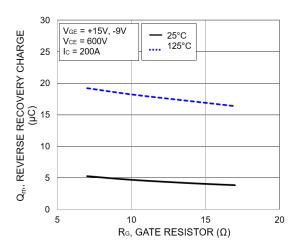


Figure 32. Typical Reverse Recovery Charge vs. R<sub>G</sub>

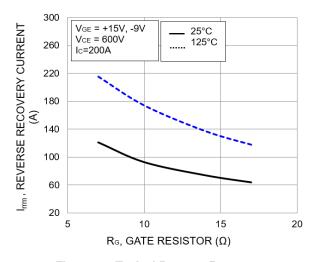


Figure 33. Typical Reverse Recovery Peak Current vs. R<sub>G</sub>

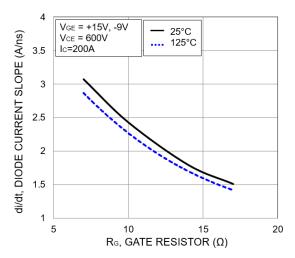


Figure 34. Typical di/dt vs. R<sub>G</sub>

# TYPICAL CHARACTERISTICS - T2 || D3 + D4 OR T3 || D1 + D2

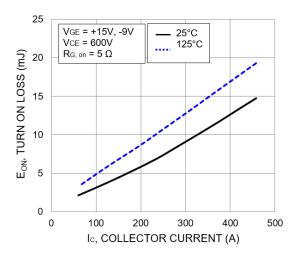


Figure 35. Typical Turn On Loss vs. lc

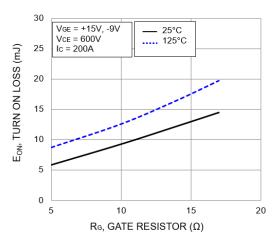


Figure 37. Typical Turn On Loss vs. R<sub>G</sub>

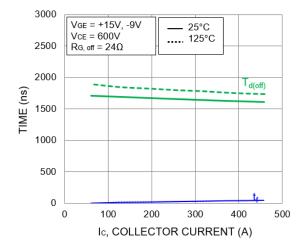


Figure 39. Typical Turn-Off Switching Time vs. lc

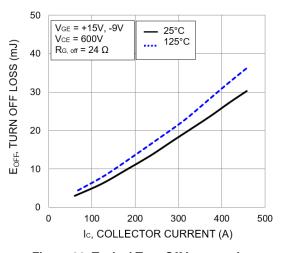


Figure 36. Typical Turn Off Loss vs. Ic

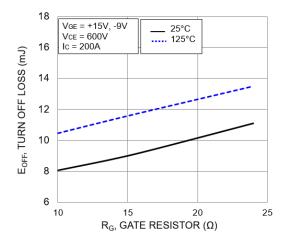


Figure 38. Typical Turn Off Loss vs. R<sub>G</sub>

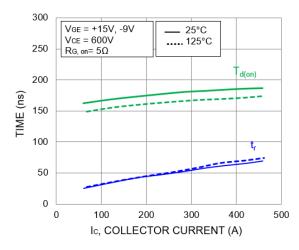


Figure 40. Typical Turn-On Switching Time vs. Ic

# TYPICAL CHARACTERISTICS - T2 || D3 + D4 OR T3 || D1 + D2

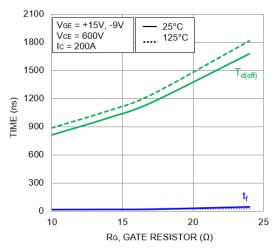


Figure 41. Typical Turn-Off Switching Time vs. R<sub>G</sub>

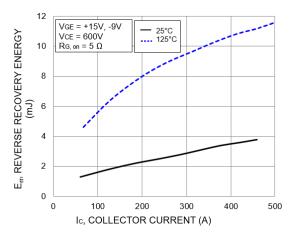


Figure 43. Typical Reverse Recovery Energy Loss vs. Ic

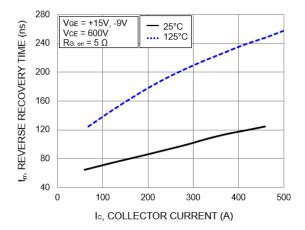


Figure 45. Typical Reverse Recovery Time vs. lc

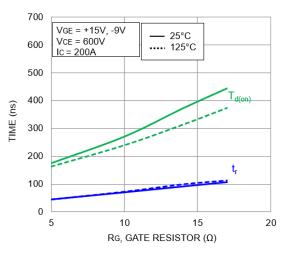


Figure 42. Typical Turn-On Switching Time vs. R<sub>G</sub>

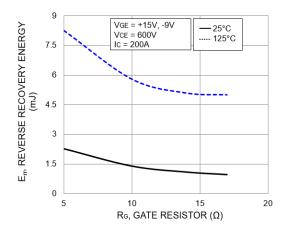


Figure 44. Typical Reverse Recovery Energy Loss vs. R<sub>G</sub>

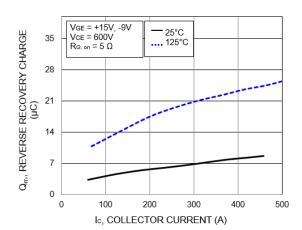


Figure 46. Typical Reverse Recovery Charge vs. Ic

# TYPICAL CHARACTERISTICS - T2 || D3 + D4 OR T3 || D1 + D2

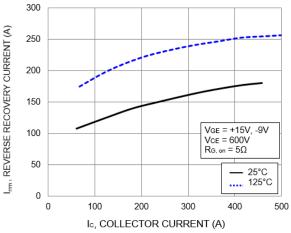


Figure 47. Typical Reverse Recovery Current vs. Ic

340

280

220

160

100

40

VGE = +15V, -9V

Vce = 600V

lc = 200A

t<sub>n</sub>, REVERSE RECOVERY TIME (ns)

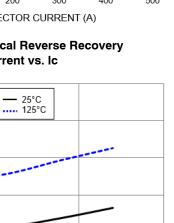


Figure 49. Typical Reverse Recovery Time vs. R<sub>G</sub>

10 15 Rs, GATE RESISTOR ( $\Omega$ )

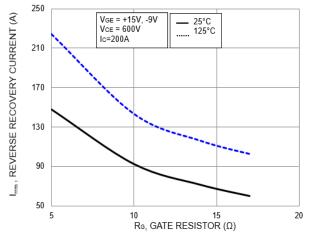


Figure 51. Typical Reverse Recovery Peak Current vs. R<sub>G</sub>

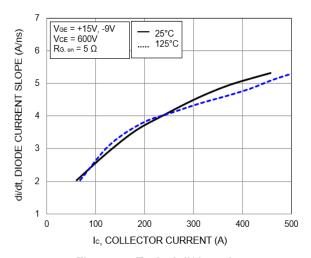


Figure 48. Typical di/dt vs. lc

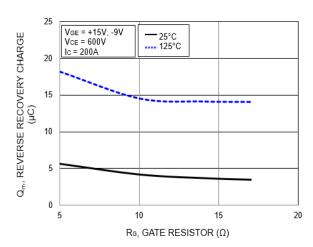


Figure 50. Typical Reverse Recovery Charge vs. R<sub>G</sub>

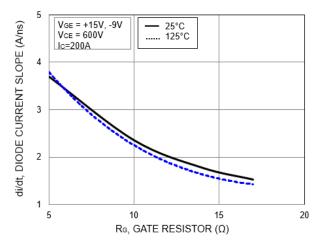


Figure 52. Typical di/dt vs. R<sub>G</sub>

20

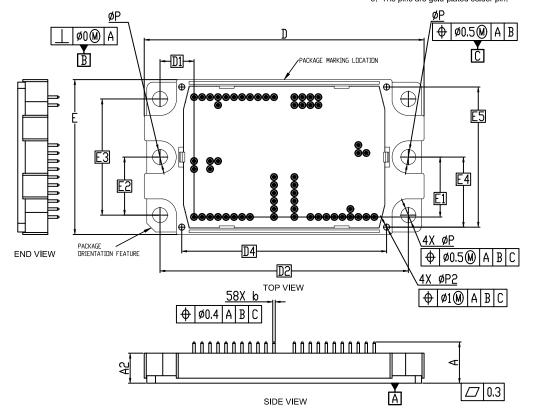
### **PACKAGE DIMENSIONS**

#### PIM58 112.00x62.00x12.00 CASE 180HX ISSUE O

**DATE 30 JUL 2024** 

#### NOTES:

- 1. Dimensioning and tolerancing conform to ASME Y14.5
- 2. All dimensions are in millimeters.
- 3. Pin-grid is 3.2mm.
- 4. Package marking is located on the side opposite the package orientation feature.
- 5. The pins are gold-plated solder pin.

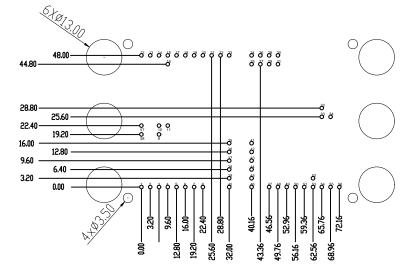


	MILLIMETERS					
DIM	MIN.	NOM.	MAX.			
Α	16.10	16.50	16.90			
A2	11.70	12.00	12.30			
b	0.95	1.00	1.05			
D	111.60	112.00	112.40			
D1		13.62 BSC				
D2	99.40 BSC					
D4	82.00 BSC					
Е	61.60	62.40				
E1		24.00 BSC				
E2		23.25 BSC				
E3	46.50 BSC					
E4	28.05 BSC					
E5	56.10 BSC					
Р	5.90	6.00	6.10			
P2	2.20	2.30	2.40			

#### **PACKAGE DIMENSIONS**

#### PIM58 112.00x62.00x12.00 CASE 180HX ISSUE O

**DATE 30 JUL 2024** 



# RECOMMENDED MOUNTING PATTERN

\* For additional Information on our Pb—Free strategy and soldering details, please download the Onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

#### NOTE 2:

				Pin table				
Pin	х	Y	Pin	×	Y	Pin	х	Υ
1	0	0	24	40.16	48	47	46.56	0
2	3.2	0	25	40.16	44.8	48	49.76	0
3	6.4	0	26	43.36	48	49	52.96	0
4	9.6	0	27	43.36	44.8	50	56.16	0
5	12.8	0	28	46.56	48	51	59.36	0
6	16	0	29	46.56	44.8	52	62.56	3.2
7	19.2	0	30	49.76	48	53	62.56	0
8	22.4	0	31	49.76	44.8	54	65.76	0
9	6.4	19.2	32	65.76	28.8	55	68.96	0
10	6.4	22.4	33	65.76	25.6	56	72.16	0
11	9.6	22.4	34	68.96	25.6	57	0	22.4
12	0	48	35	32	16	58	0	19.2
13	3.2	48	36	32	12.8			
14	6.4	48	37	32	9.6			
15	9.6	48	38	32	6.4			
16	0.6	44.0	20	22	2.2	l		

32

40.16

40.16

40.16

40.16

40.16

16

12.8

9.6

6.4

3.2

# GENERIC MARKING DIAGRAM\*

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
FRONTSIDE MARKING	
2D CODE	

#### BACKSIDE MARKING

XXXXX = Specific Device Code
AT = Assembly & Test Site Code

AT = Assembly & Test Site Code

YYWW = Year and Work Week Code

may no

\*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.

17

18

19

20

21

22

23

12.8

16

19.2

22.4

25.6

28.8

32

48

48

48

48

40

42

43

44

45

onsemi, ONSEMI, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at <a href="www.onsemi.com/site/pdf/Patent-Marking.pdf">www.onsemi.com/site/pdf/Patent-Marking.pdf</a>. Onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any EDA class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer pu

#### ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS:** 

 $\textbf{Technical Library:} \ \underline{www.onsemi.com/design/resources/technical-documentation}$ 

onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at

www.onsemi.com/support/sales