Three Level ANPC Q2Pack Module

NXH800A100L4Q2F2S1G/P1G, NXH800A100L4Q2F2S2G/P2G

This high−density, integrated power module combines high−performance IGBTs with rugged anti−parallel diodes.

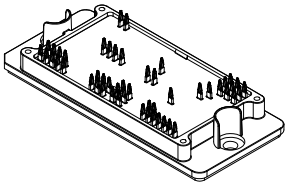
Features

- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout
- Low Package Height
- This is a Pb−Free Device

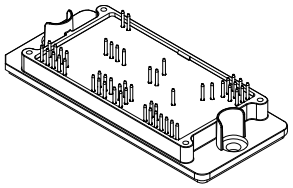
Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies Systems

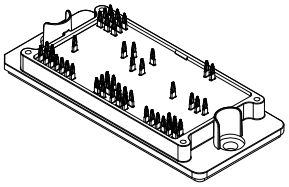
PACKAGE PICTURE



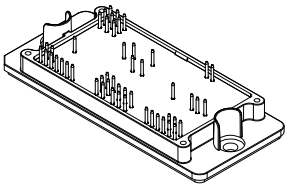
Q2PACK POSITIVE PRESS FIT PINS
CASE 180HG



Q2PACK POSITIVE SOLDER PINS
CASE 180HH



Q2PACK NEGATIVE PRESS FIT PINS
CASE 180CQ



Q2PACK NEGATIVE SOLDER PINS
CASE 180BM

MARKING DIAGRAMS

See detailed marking diagrams on page 2 of this data sheet.

PIN CONNECTIONS

See detailed pin connections on page 2 of this data sheet.

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

SCHEMATICS

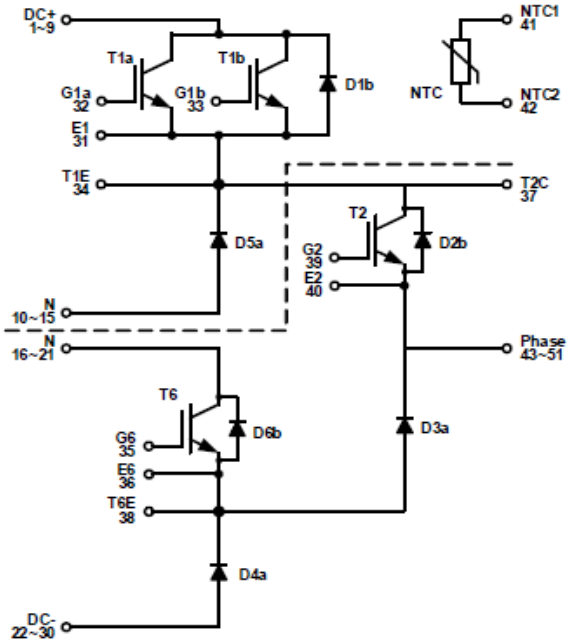


Figure 1. NXH800A100L4Q2F2X1G
Schematic Diagram

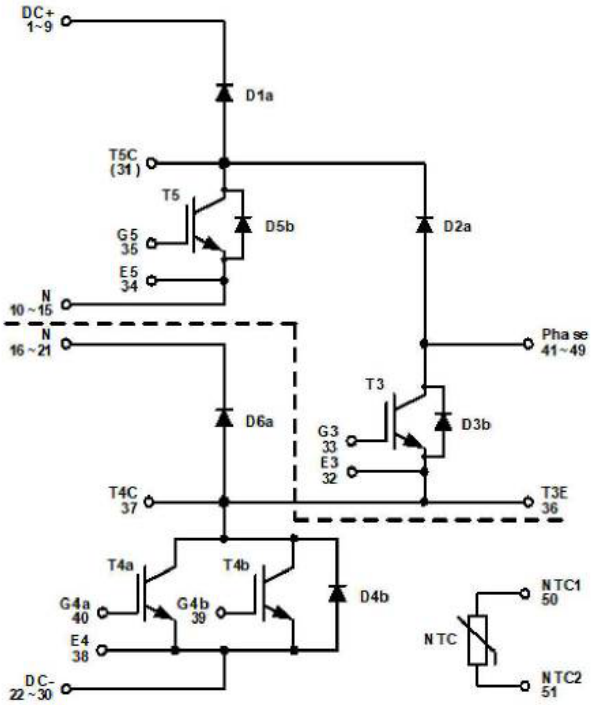
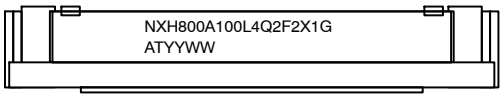


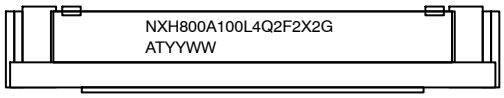
Figure 2. NXH800A100L4Q2F2X2G
Schematic Diagram

MARKING DIAGRAMS



NXH800A100L4Q2F2	= Specific Device Code
X	= P or S
G	= Pb−Free Package
AT	= Assembly & Test Site Code
YYWW	= Year and Work Week Code

Figure 3. NXH800A100L4Q2F2X1G
Marking Diagram



NXH800A100L4Q2F2	= Specific Device Code
X	= P or S
G	= Pb−Free Package
AT	= Assembly & Test Site Code
YYWW	= Year and Work Week Code

Figure 4. NXH800A100L4Q2F2X2G
Marking Diagram

PIN CONNECTIONS

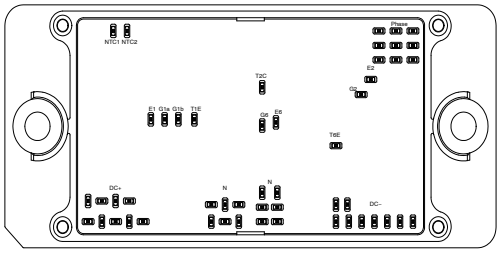


Figure 5. NXH800A100L4Q2F2X1G
Pin Connection

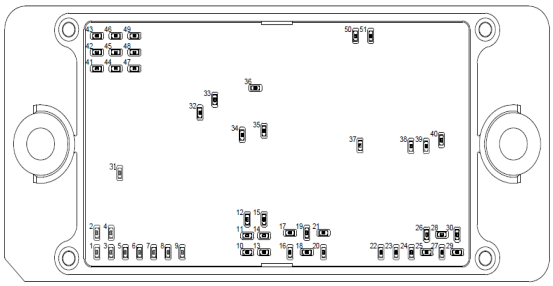


Figure 6. NXH800A100L4Q2F2X2G
Pin Connection

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

Rating	Symbol	Value	Unit
OUTER IGBT (T1a, T1b, T4a, T4b)			
Collector-Emitter Voltage	V_{CES}	1000	V
Gate-Emitter Voltage Positive Transient Gate−Emitter Voltage (T_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 80°C	I_C	309	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C)	$I_{C(Pulse)}$	927	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	714	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature (Note 1)	T_{JMAX}	175	°C
INNER IGBT (T2, T3)			
Collector-Emitter Voltage	V_{CES}	1000	V
Gate-Emitter Voltage Positive Transient Gate−Emitter Voltage (T_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 80°C	I_C	413	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C)	$I_{C(Pulse)}$	1239	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	990	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature (Note 1)	T_{JMAX}	175	°C
NEUTRAL POINT IGBT (T5, T6)			
Collector−Emitter Voltage	V_{CES}	1000	V
Gate-Emitter Voltage Positive Transient Gate−Emitter Voltage (T_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 80°C	I_C	224	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C)	$I_{C(Pulse)}$	672	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	543	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature (Note 1)	T_{JMAX}	175	°C
IGBT INVERSE DIODE (D1b, D2b, D3b, D4b, D5b, D6b)			
Peak Repetitive Reverse Voltage	V_{RRM}	1000	V
Continuous Forward Current @ T_C = 80°C	I_F	61	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	183	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	151	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
DIODES (D1a, D2a, D3a, D4a)			
Peak Repetitive Reverse Voltage	V_{RRM}	1000	V
Continuous Forward Current @ T_C = 80°C	I_F	177	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	531	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	446	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

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

Rating	Symbol	Value	Unit
NEUTRAL POINT DIODES (D5a, D6a)			
Peak Repetitive Reverse Voltage	V_{RRM}	1000	V
Continuous Forward Current @ T_C = 80°C	I_F	238	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	714	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	565	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

Table 2. THERMAL AND INSULATION PROPERTIES (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
THERMAL PROPERTIES			
Operating Temperature under Switching Condition	T_{VJOP}	−40 to +150	°C
Storage Temperature Range	T_{stg}	−40 to +125	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz	V_{is}	4000	V_{RMS}
Creepage Distance		12.7	mm
Comparative Tracking Index	CTI	> 600	

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)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T1a, T1b, T4a, T4b) CHARACTERISTICS						
Collector-Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	20	μA
Collector-Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 400 A, T_J = 25°C	$V_{CE(sat)}$	–	1.69	2.3	V
	V_{GE} = 15 V, I_C = 400 A, T_J = 175°C		–	1.95	–	
Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 400 mA	$V_{GE(TH)}$	3.4	4.92	6.7	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	±2	μA
Turn-on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V R_{Goff} = 23 Ω, R_{Gon} = 15 Ω (T1a, T1b tested together)	$t_{d(on)}$	–	189.93	–	ns
Rise Time		t_r	–	52.06	–	
Turn-off Delay Time		$t_{d(off)}$	–	970.3	–	
Fall Time		t_f	–	22.56	–	
Turn-on Switching Loss per Pulse		E_{on}	–	7.71	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	8.12	–	
Turn-on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V R_{Goff} = 23 Ω, R_{Gon} = 15 Ω (T1a, T1b tested together)	$t_{d(on)}$	–	164.22	–	ns
Rise Time		t_r	–	59.58	–	
Turn-off Delay Time		$t_{d(off)}$	–	1088.34	–	
Fall Time		t_f	–	33.6	–	
Turn-on Switching Loss per Pulse		E_{on}	–	11.57	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	10.77	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz (T1a, T1b tested together)	C_{ies}	–	49700	–	pF
Output Capacitance		C_{oes}	–	1530	–	
Reverse Transfer Capacitance		C_{res}	–	308	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 300 A, V_{GE} = −15 V~15 V (T1a, T1b tested together)	Q_g	–	3040	–	nC
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.225	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.133	–	K/W
IGBT INVERSE DIODE (D1b, D2b, D3b, D4b, D5b, D6b) CHARACTERISTICS						
Diode Forward Voltage	I_F = 100 A, T_J = 25°C	V_F	–	2.73	3.7	V
	I_F = 100 A, T_J = 175°C		–	2.39	–	
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.770	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.63	–	K/W

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T2, T3) CHARACTERISTICS						
Collector-Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	20	μA
Collector-Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 600 A, T_J = 25°C	$V_{CE(sat)}$	–	1.75	2.3	V
	V_{GE} = 15 V, I_C = 600 A, T_J = 175°C		–	2.15	–	
Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 600 mA	$V_{GE(TH)}$	3.4	4.83	6.7	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	±2	μA
Turn-on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V R_{Gon} = 11 Ω, R_{Goff} = 23 Ω	$t_{d(on)}$	–	233.73	–	ns
Rise Time		t_r	–	68	–	
Turn-off Delay Time		$t_{d(off)}$	–	1364.18	–	
Fall Time		t_f	–	79.12	–	
Turn-on Switching Loss per Pulse		E_{on}	–	7.83	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	16.73	–	
Turn-on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V R_{Gon} = 11 Ω, R_{Goff} = 23 Ω	$t_{d(on)}$	–	213.78	–	ns
Rise Time		t_r	–	75.99	–	
Turn-off Delay Time		$t_{d(off)}$	–	1514.94	–	
Fall Time		t_f	–	47.53	–	
Turn-on Switching Loss per Pulse		E_{on}	–	10.87	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	17.39	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz	C_{ies}	–	38100	–	pF
Output Capacitance		C_{oes}	–	1230	–	
Reverse Transfer Capacitance		C_{res}	–	226	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 300 A, V_{GE} = 15 V	Q_g	–	2230	–	nC
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.168	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.096	–	K/W
DIODES (D1a, D2a, D3a, D4a) CHARACTERISTICS						
Diode Forward Voltage	I_F = 300 A, T_J = 25°C	V_F	–	2.76	3.7	V
	I_F = 300 A, T_J = 175°C		–	2.43	–	
Reverse Recovery Time	T_J = 25°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_G = 11 Ω	t_{rr}	–	105.26	–	ns
Reverse Recovery Charge		Q_{rr}	–	4.344	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	106.04	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	3.242	–	A/ns
Reverse Recovery Energy		E_{rr}	–	1.304	–	mJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_G = 11 Ω	t_{rr}	–	176.9	–	ns
Reverse Recovery Charge		Q_{rr}	–	12.771	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	154.24	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2.795	–	A/ns
Reverse Recovery Energy		E_{rr}	–	4.318	–	mJ
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.315	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.213	–	K/W

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T5, T6) CHARACTERISTICS						
Collector-Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1000 V	I_{CES}	–	–	20	μA
Collector-Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 300 A, T_J = 25°C	$V_{CE(sat)}$	–	1.70	2.3	V
	V_{GE} = 15 V, I_C = 300 A, T_J = 175°C		–	2.05	–	
Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 300 mA	$V_{GE(TH)}$	4.1	5.03	6.0	V
Gate Leakage Current	V_{GE} = ±20 V, V_{CE} = 0 V	I_{GES}	–	–	±2	μA
Turn-on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_{Gon} = 11 Ω, R_{Goff} = 23 Ω	$t_{d(on)}$	–	120.19	–	ns
Rise Time		t_r	–	50.18	–	
Turn-off Delay Time		$t_{d(off)}$	–	682.65	–	
Fall Time		t_f	–	39.56	–	
Turn-on Switching Loss per Pulse		E_{on}	–	8.58	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	7.82	–	
Turn-on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_{Gon} = 11 Ω, R_{Goff} = 23 Ω	$t_{d(on)}$	–	112.48	–	ns
Rise Time		t_r	–	57.46	–	
Turn-off Delay Time		$t_{d(off)}$	–	747.87	–	
Fall Time		t_f	–	23.765	–	
Turn-on Switching Loss per Pulse		E_{on}	–	13.77	–	mJ
Turn-off Switching Loss per Pulse		E_{off}	–	10.41	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz	C_{ies}	–	17400	–	pF
Output Capacitance		C_{oes}	–	654	–	
Reverse Transfer Capacitance		C_{res}	–	101	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 300 A, V_{GE} = 15 V	Q_g	–	1004	–	nC
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.264	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.175	–	K/W
DIODES (D5a, D6a) CHARACTERISTICS						
Diode Forward Voltage	I_F = 400 A, T_J = 25°C	V_F	–	2.83	3.7	V
	I_F = 400 A, T_J = 175°C		–	2.42	–	
Reverse Recovery Time	T_J = 25°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_G = 15 Ω	t_{rr}	–	92.74	–	ns
Reverse Recovery Charge		Q_{rr}	–	5.66	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	136.18	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	3.14	–	A/ns
Reverse Recovery Energy		E_{rr}	–	2.03	–	mJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 600 V, I_C = 200 A V_{GE} = −9 V, 15 V, R_G = 15 Ω	t_{rr}	–	159.63	–	ns
Reverse Recovery Charge		Q_{rr}	–	17.00	–	μC
Peak Reverse Recovery Current		I_{RRM}	–	223.97	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	2.71	–	A/ns
Reverse Recovery Energy		E_{rr}	–	6.80	–	mJ
Thermal Resistance – Chip-to-Heatsink	Thermal grease, Thickness = 2.1 Mil ±2% λ = 2.9 W/mK	R_{thJH}	–	0.244	–	K/W
Thermal Resistance – Chip-to-Case		R_{thJC}	–	0.168	–	K/W

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R_{25}	–	22	–	kΩ
Nominal Resistance	T = 100°C	R_{100}	–	1504	–	Ω
Deviation of R25		ΔR/R	−1	–	1	%
Power Dissipation		P_D	–	187.5	–	mW
Power Dissipation Constant			–	1.5	–	mW/K
B-value	B(25/100), tolerance ±3%		–	3980	–	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

Part Number	Marking	Package	Shipping
NXH800A100L4Q2F2S1G	NXH800A100L4Q2F2S1G	Q2PACK – Case 180HH (Pb−Free/Halide−Free)	12 Units / Blister Tray
NXH800A100L4Q2F2P1G	NXH800A100L4Q2F2P1G	Q2PACK – Case 180HG (Pb−Free/Halide−Free)	12 Units / Blister Tray
NXH800A100L4Q2F2S2G	NXH800A100L4Q2F2S2G	Q2PACK – Case 180BM (Pb−Free/Halide−Free)	12 Units / Blister Tray
NXH800A100L4Q2F2P2G	NXH800A100L4Q2F2P2G	Q2PACK – Case 180CQ (Pb−Free/Halide−Free)	12 Units / Blister Tray

TYPICAL CHARACTERISTICS – IGBT T1/T4 AND D5A/D6A DIODE

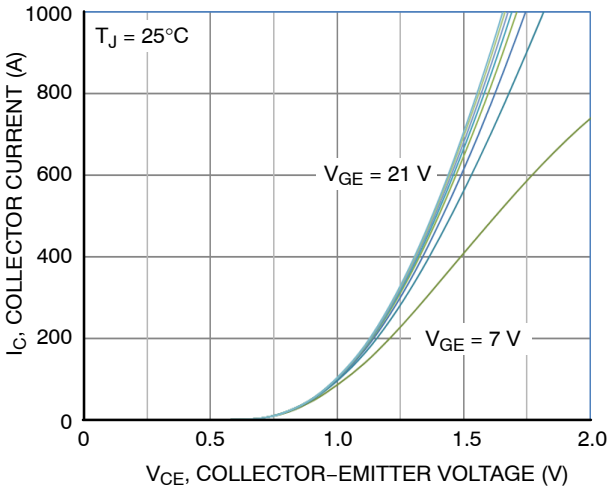


Figure 7. Typical Output Characteristics

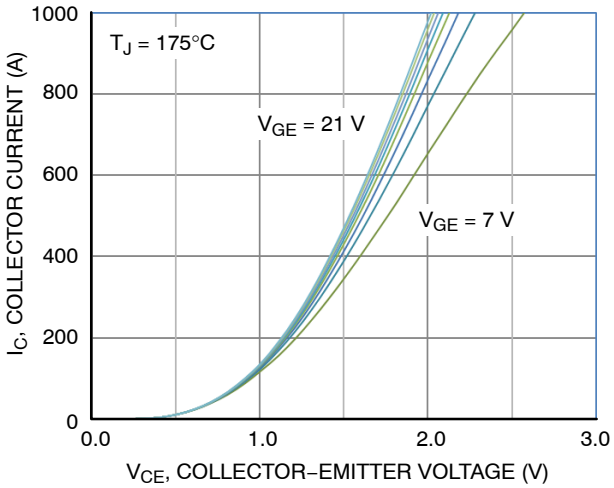


Figure 8. Typical Output Characteristics

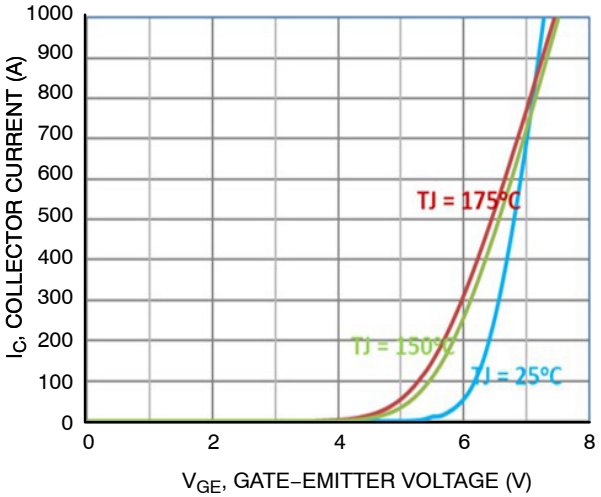


Figure 9. Transfer Characteristics

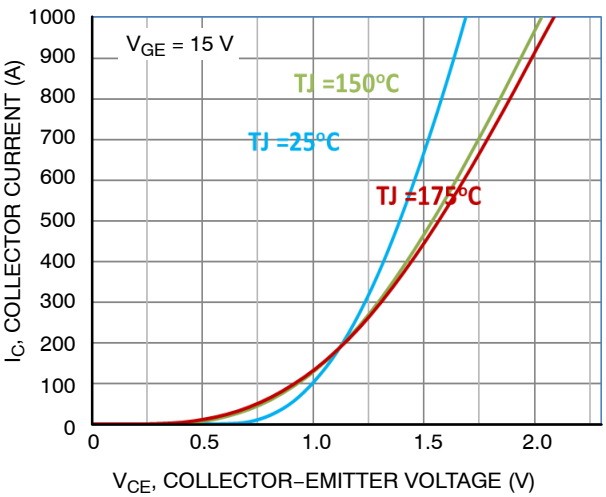


Figure 10. Saturation Voltage Characteristics

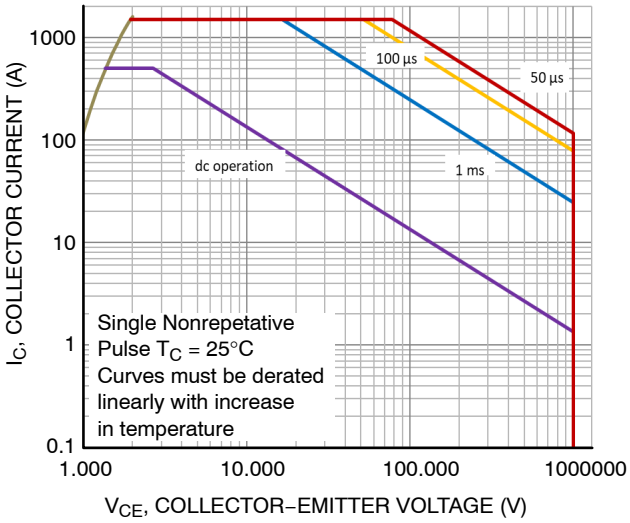


Figure 11. FBSOA

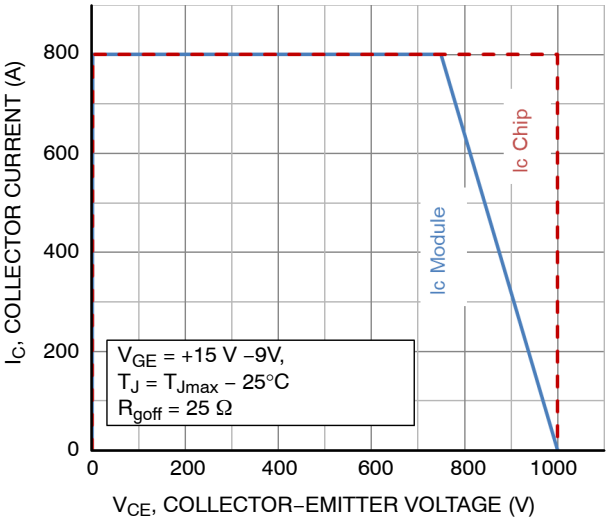


Figure 12. RBSOA

TYPICAL CHARACTERISTICS – IGBT T1/T4 AND D5A/D6A DIODE (CONTINUED)

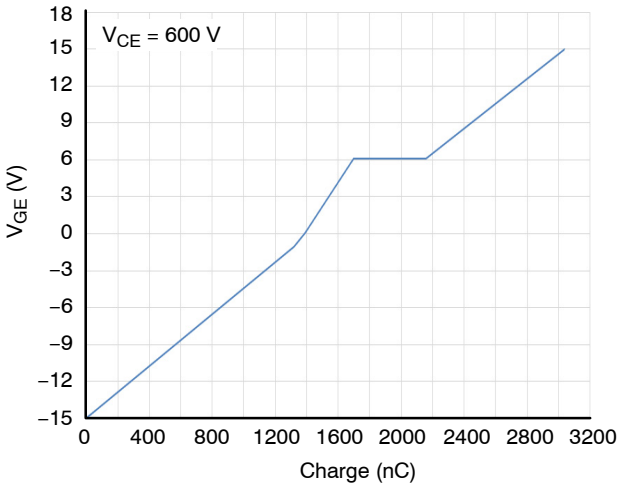


Figure 13. Gate Voltage vs. Gate Charge (T1a +T1b)

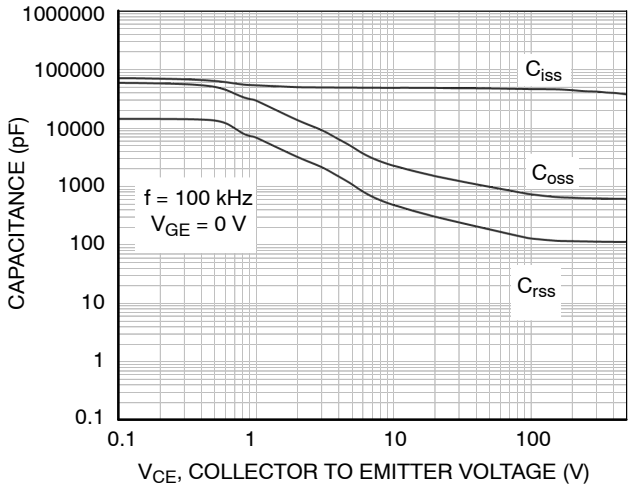


Figure 14. Capacitance (T1, T4)

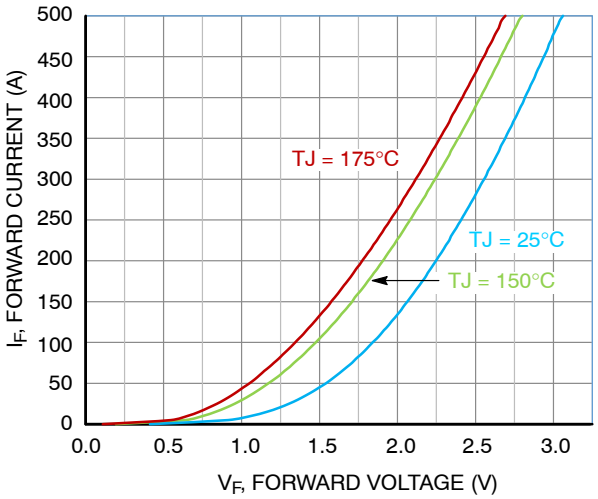


Figure 15. Diode Forward Characteristics

TYPICAL CHARACTERISTICS – IGBT T2/T3 AND D1A/D4A, D2A/D3A DIODE

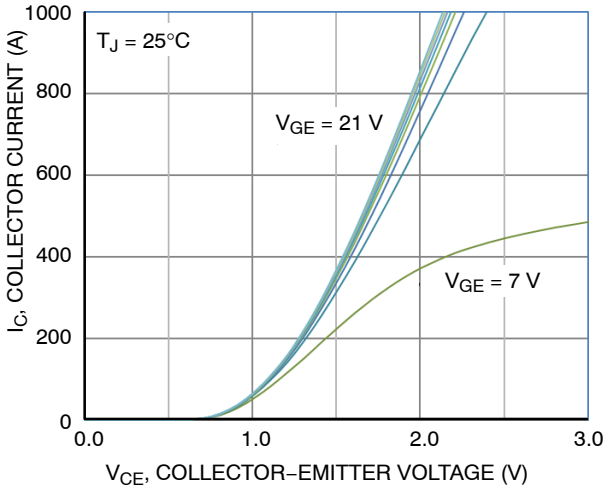


Figure 16. Typical Output Characteristics

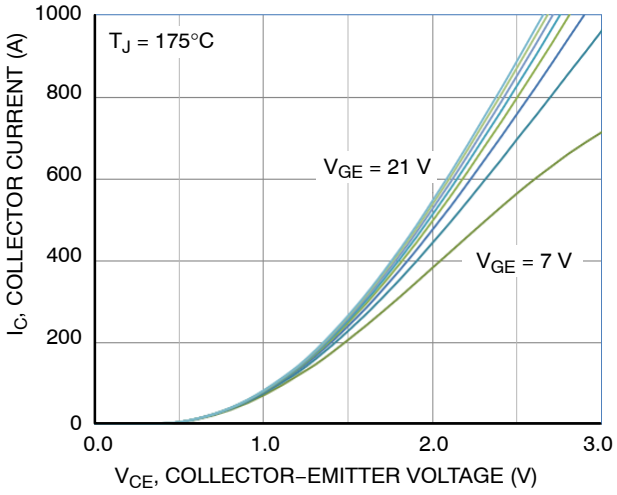


Figure 17. Typical Output Characteristics

TYPICAL CHARACTERISTICS – IGBT T2/T3 AND D1A/D4A, D2A/D3A DIODE (CONTINUED)

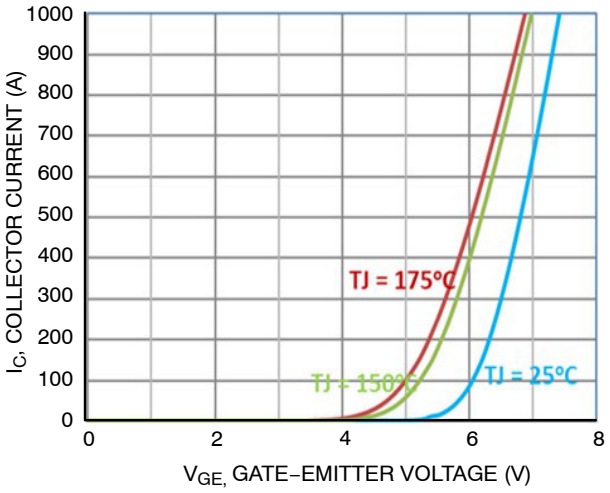


Figure 18. Transfer Characteristics

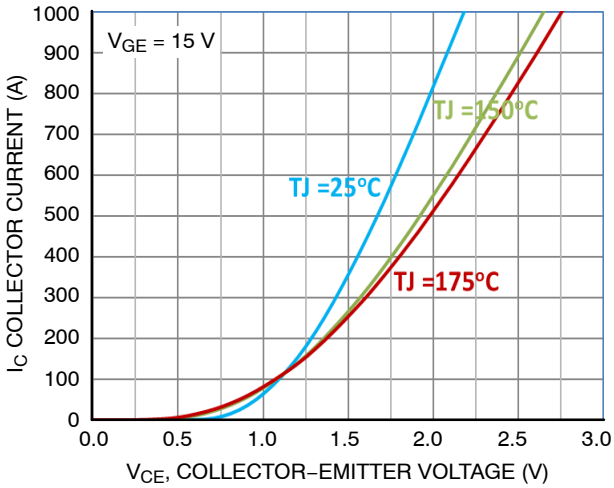


Figure 19. Saturation Voltage Characteristic

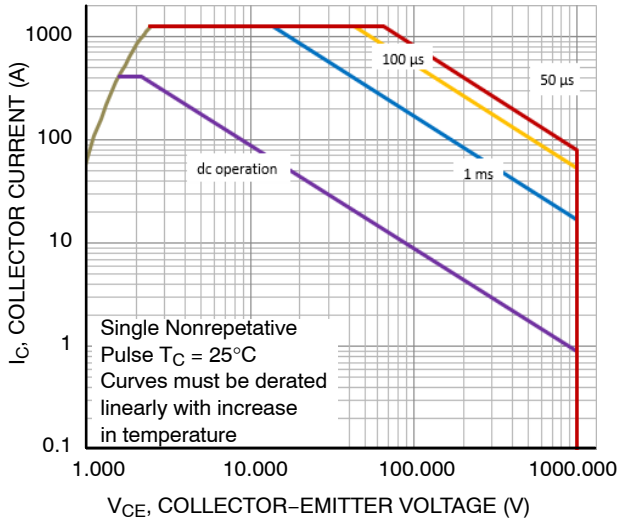


Figure 20. FBSOA

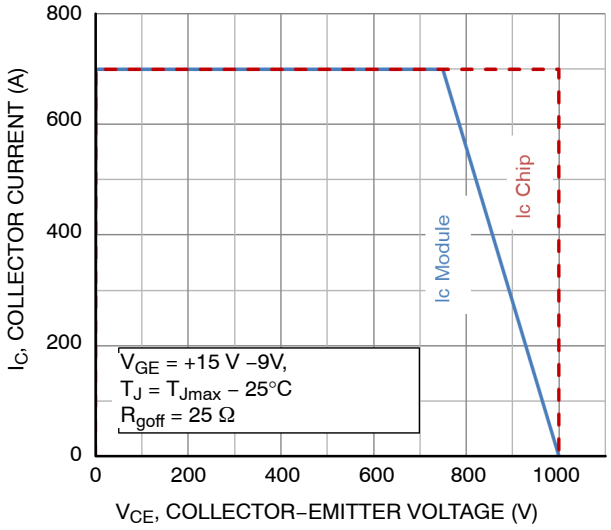


Figure 21. RBSOA

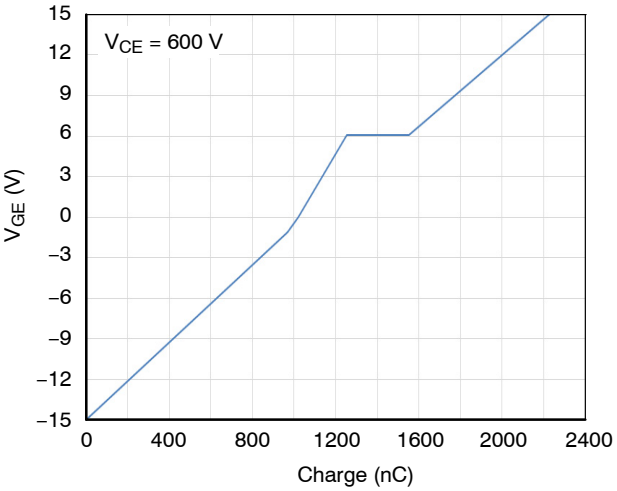


Figure 22. Gate Voltage vs. Gate Charge

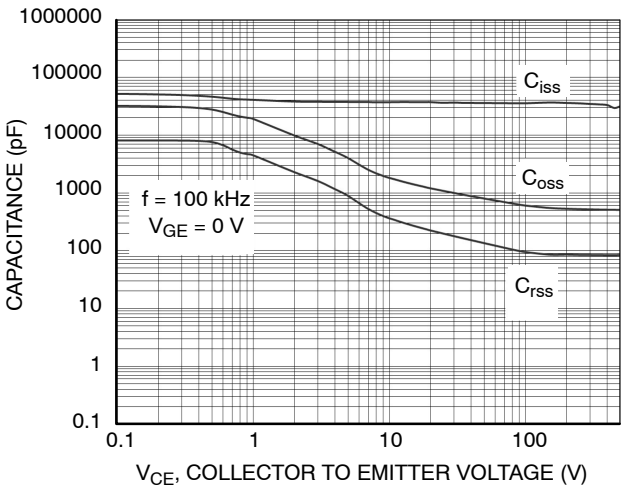


Figure 23. Capacitance

TYPICAL CHARACTERISTICS – IGBT T2/T3 AND D1A/D4A, D2A/D3A DIODE (CONTINUED)

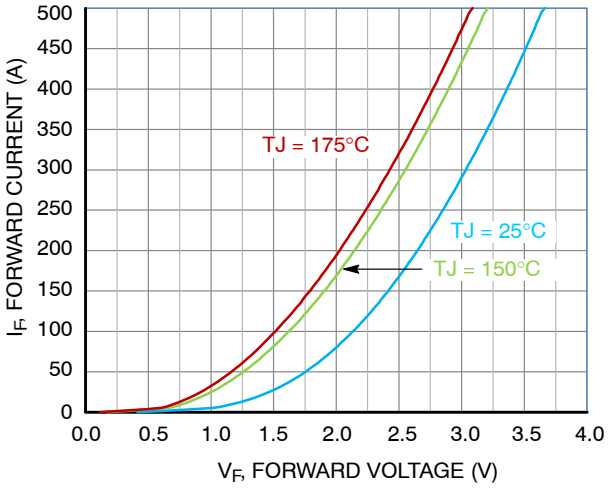


Figure 24. Diode Forward Characteristics

TYPICAL CHARACTERISTICS – IGBT T5/T6 AND D1B/D2B/D6B, D3B/D4B/D5B DIODE (CONTINUED)

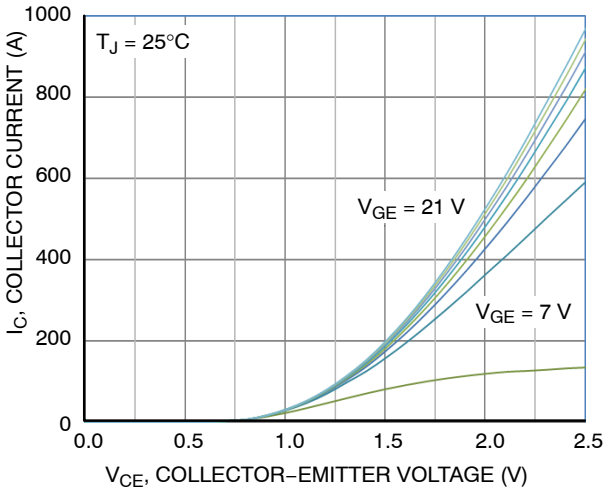


Figure 25. Typical Output Characteristics

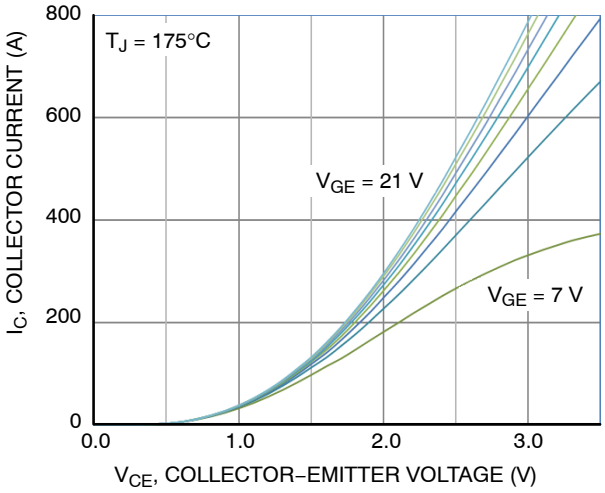


Figure 26. Typical Output Characteristics

TYPICAL CHARACTERISTICS – IGBT T5/T6 AND D1B/D2B/D6B, D3B/D4B/D5B DIODE (CONTINUED)

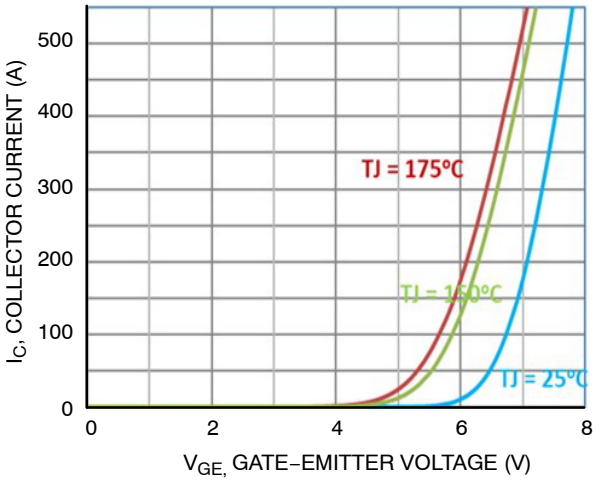


Figure 27. Transfer Characteristics

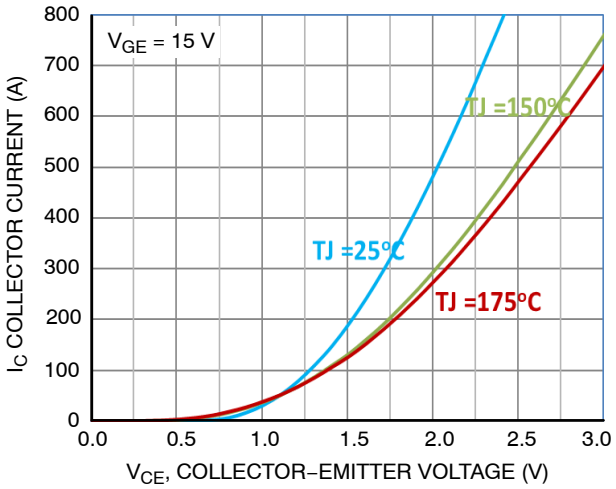


Figure 28. Saturation Voltage Characteristic

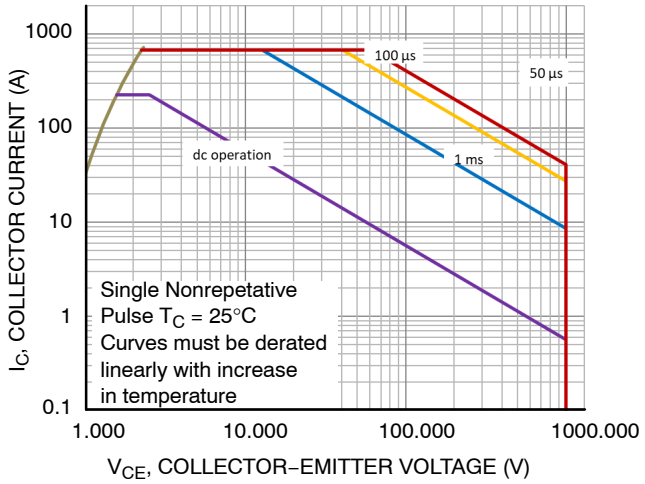


Figure 29. FBSOA

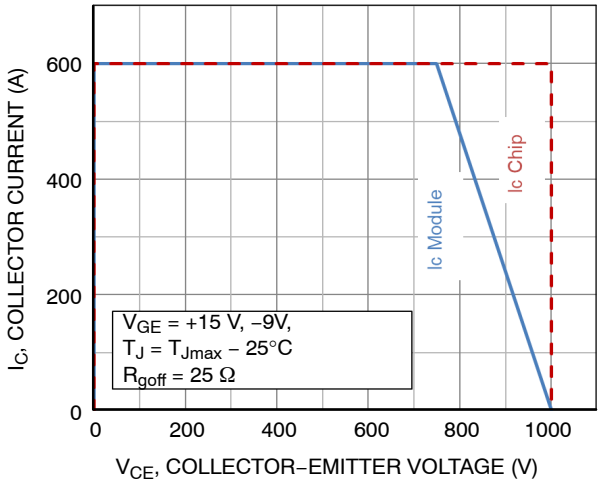


Figure 30. RBSOA

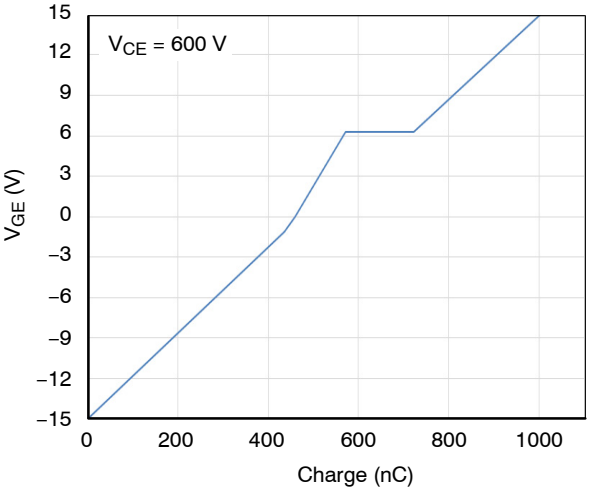


Figure 31. Gate Voltage vs. Gate Charge

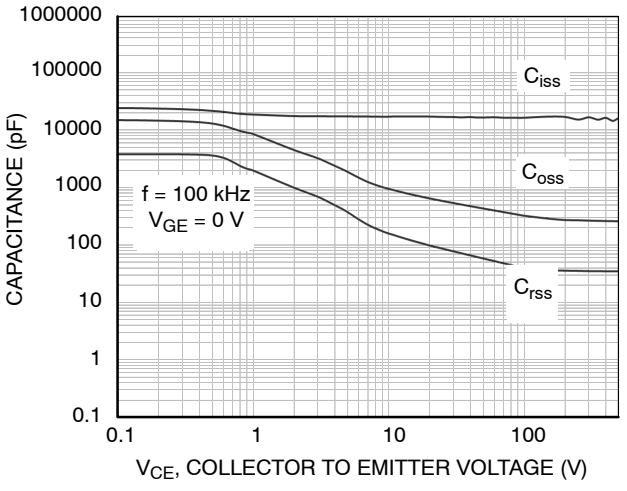


Figure 32. Capacitance

TYPICAL CHARACTERISTICS – IGBT T5/T6 AND D1B/D2B/D6B, D3B/D4B/D5B DIODE (CONTINUED)

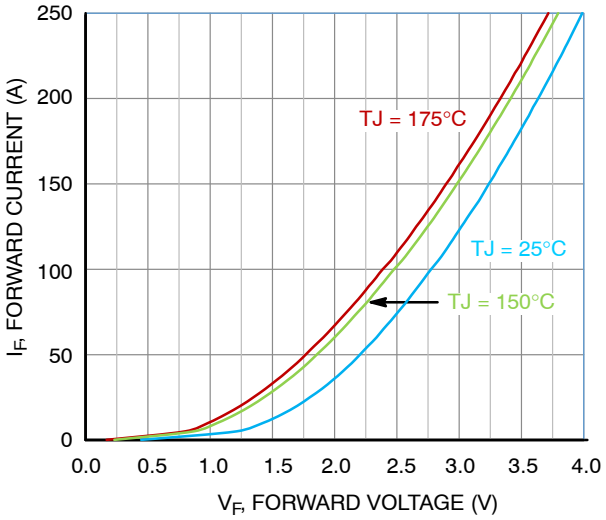


Figure 33. Diode Forward Characteristics

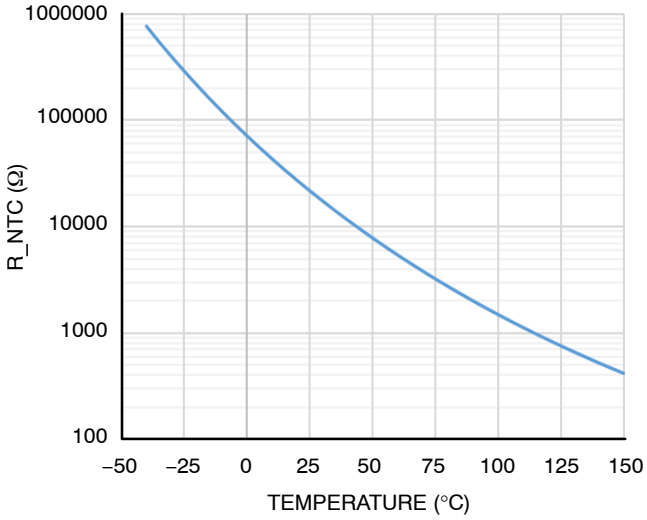


Figure 34. Temperature vs. NTC Value

TYPICAL CHARACTERISTICS – IGBT AND DIODE

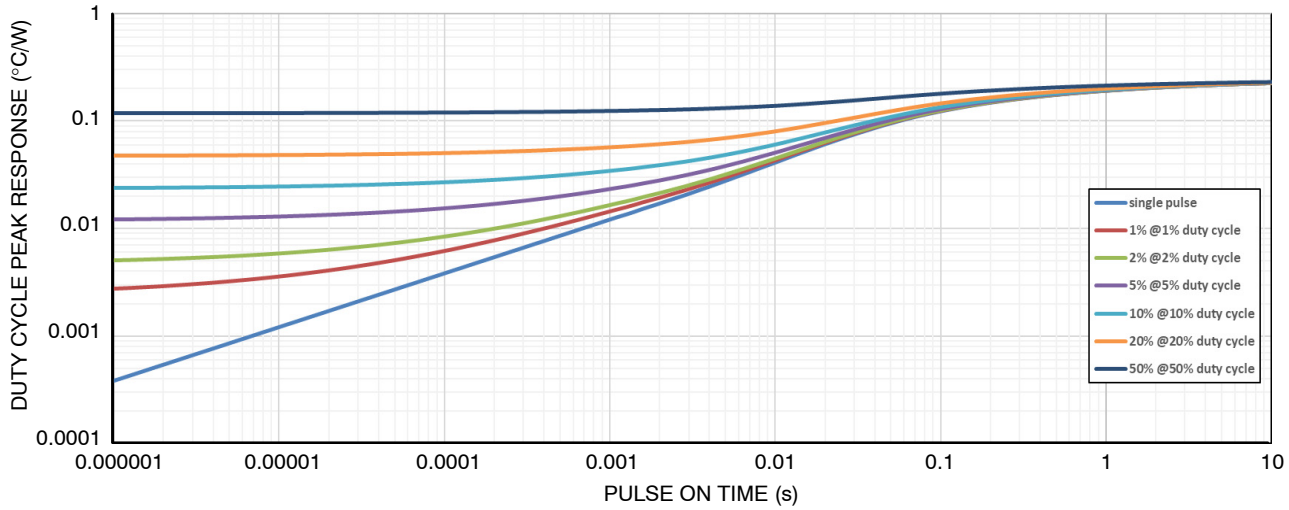


Figure 35. Transient Thermal Impedance (T1a, T1b, T4a, T4b)

TYPICAL CHARACTERISTICS – IGBT AND DIODE (CONTINUED)

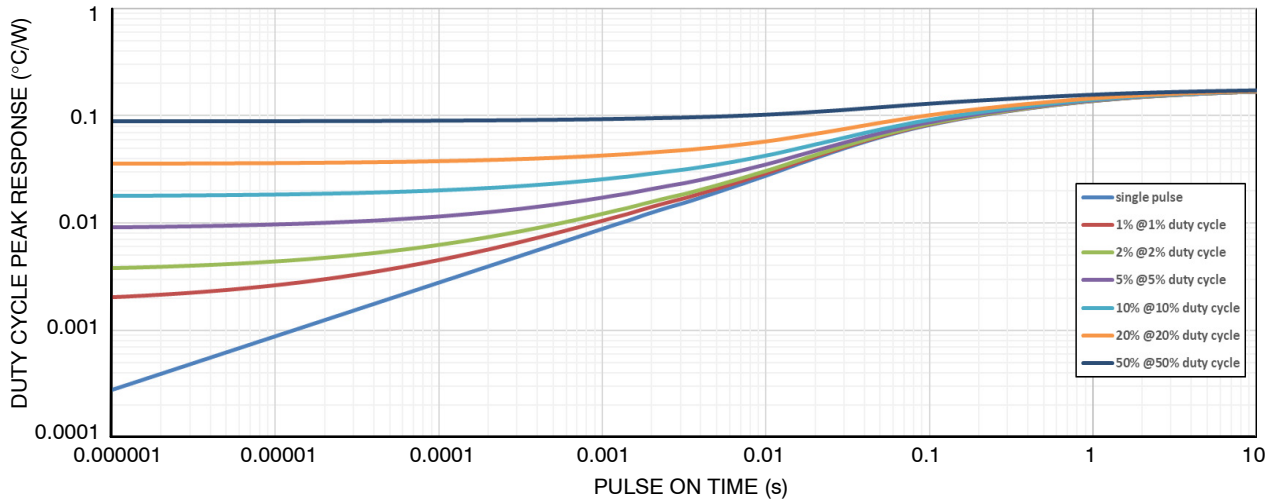


Figure 36. Transient Thermal Impedance (T2, T3)

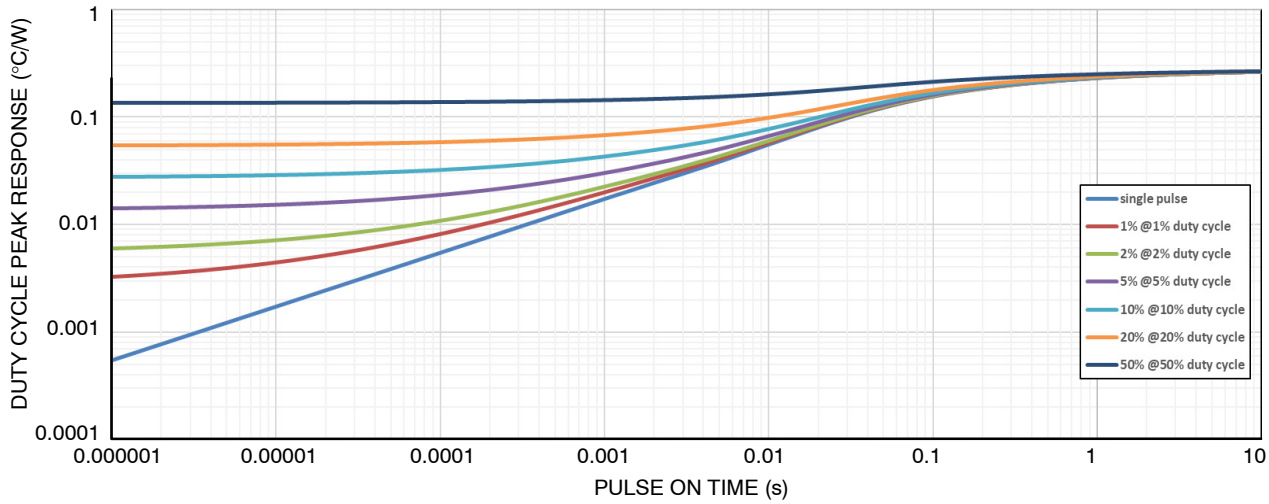


Figure 37. Transient Thermal Impedance (T5, T6)

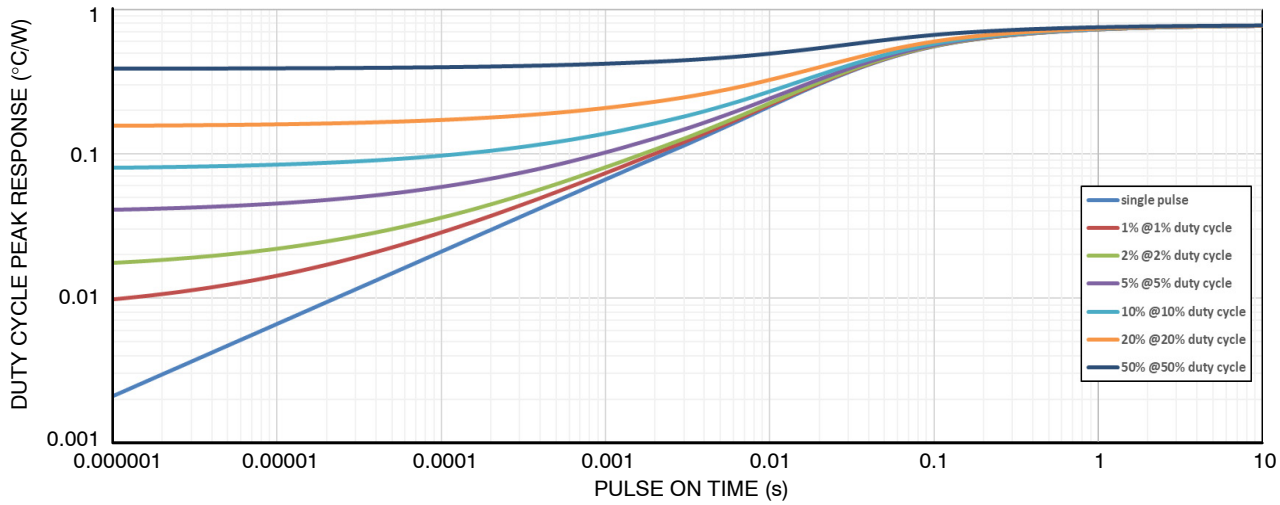


Figure 38. Transient Thermal Impedance (D1b, D2b, D3b, D4b, D5b, D6b)

TYPICAL CHARACTERISTICS – IGBT AND DIODE (CONTINUED)

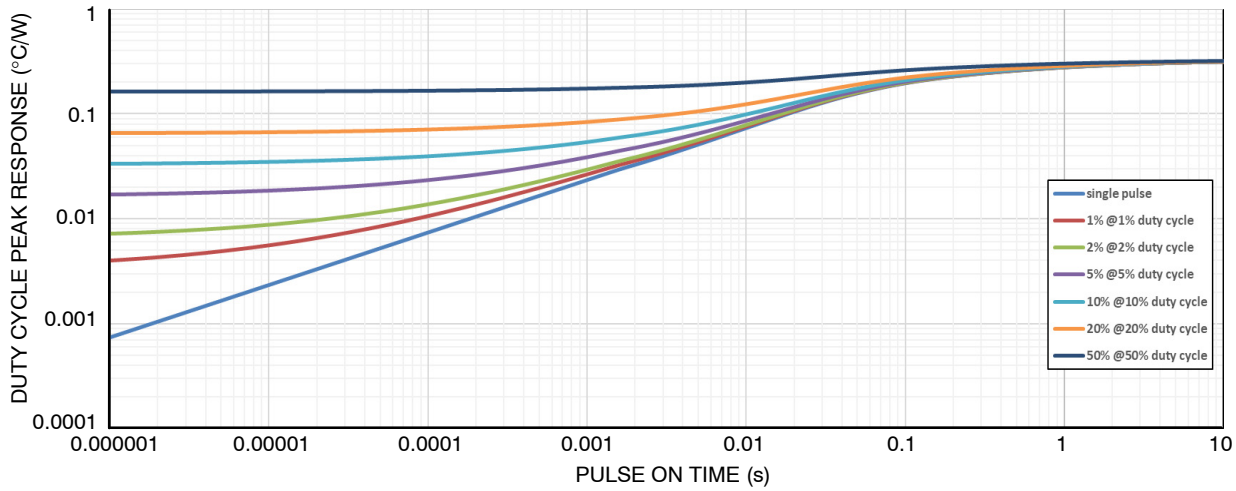


Figure 39. Transient Thermal Impedance (D1a, D2a, D3a, D4a)

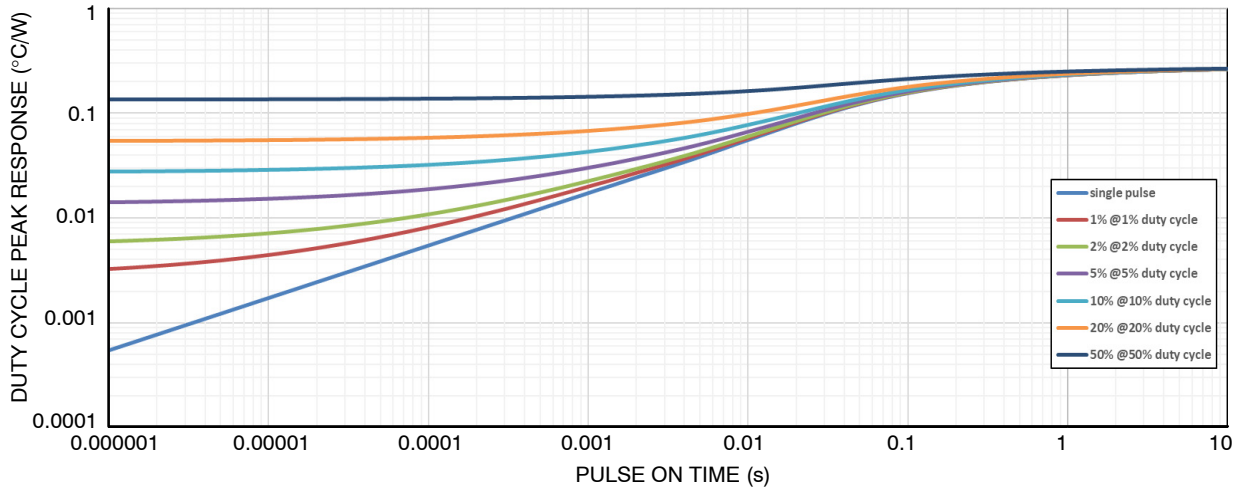


Figure 40. Transient Thermal Impedance (D5a, D6a)

TYPICAL CHARACTERISTICS – T1 ↻ D5A OR T4 ↻ D6A

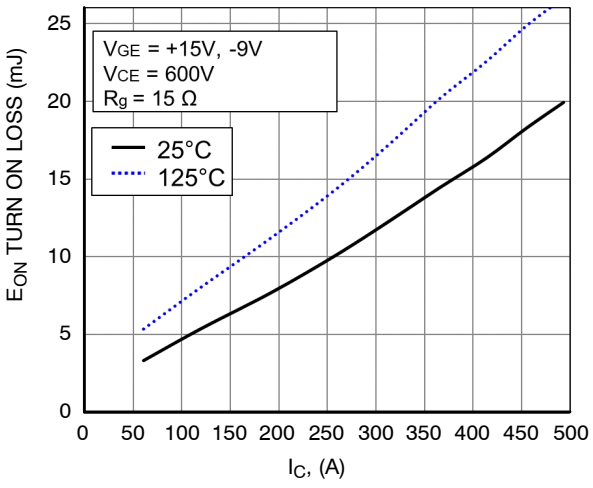


Figure 41. Typical Turn On Loss vs. I_C

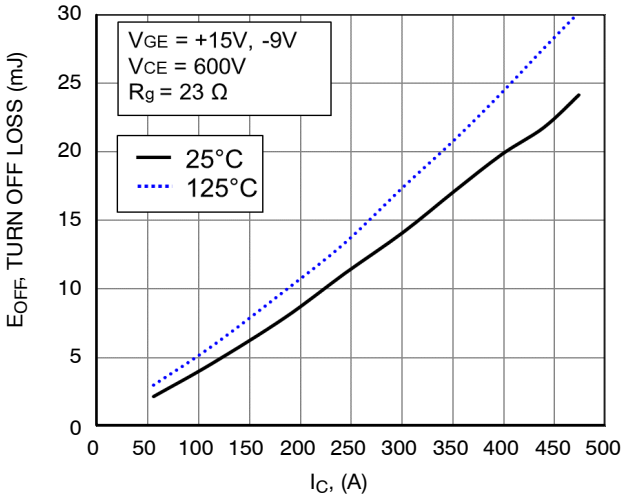


Figure 42. Typical Turn Off Loss vs. I_C

TYPICAL CHARACTERISTICS – T1↻D5A OR T4↻D6A (CONTINUED)

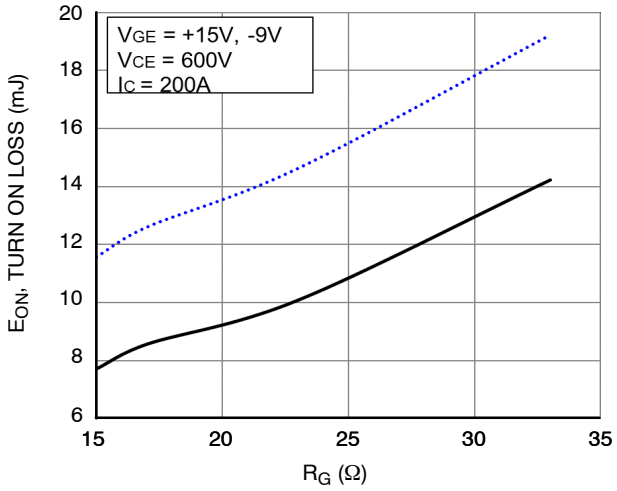


Figure 43. Typical Turn On Loss vs. R_G

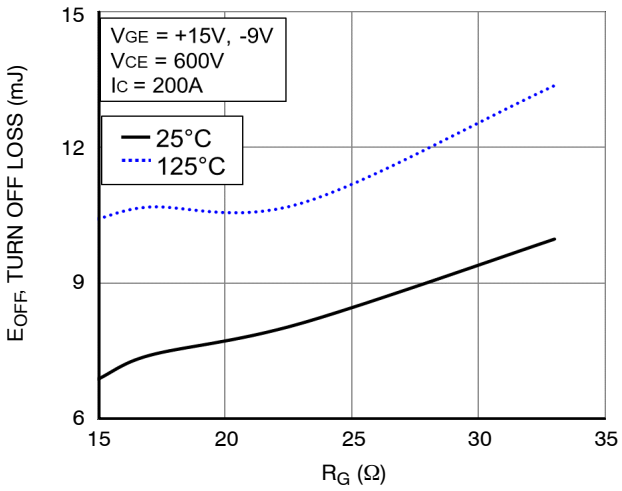


Figure 44. Typical Turn Off Loss vs. R_G

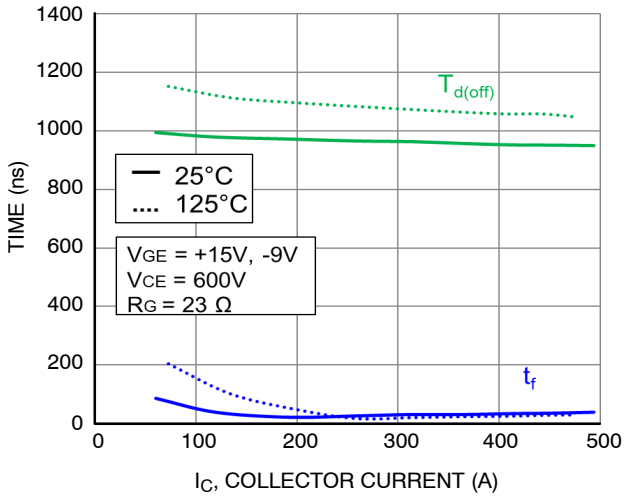


Figure 45. Typical Turn−Off Switching Time vs. I_C

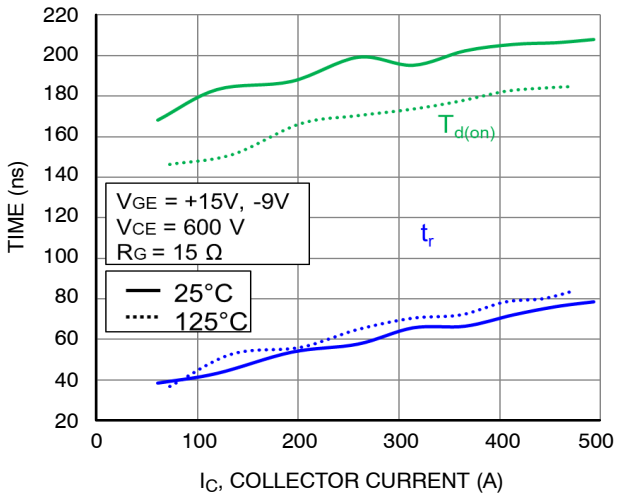


Figure 46. Typical Turn−On Switching Time vs. I_C

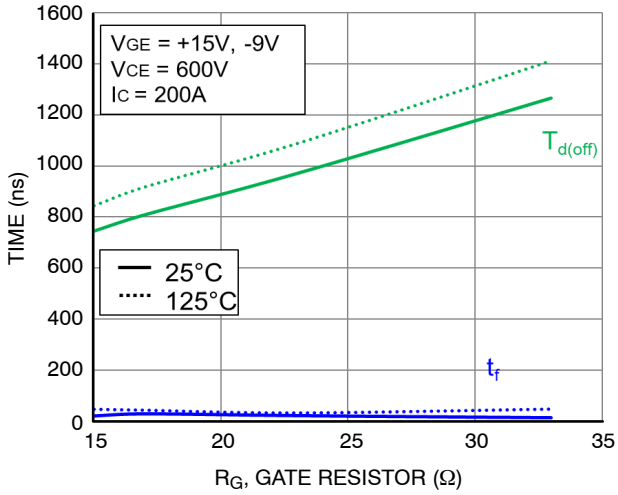


Figure 47. Typical Turn−Off Switching Time vs. R_G

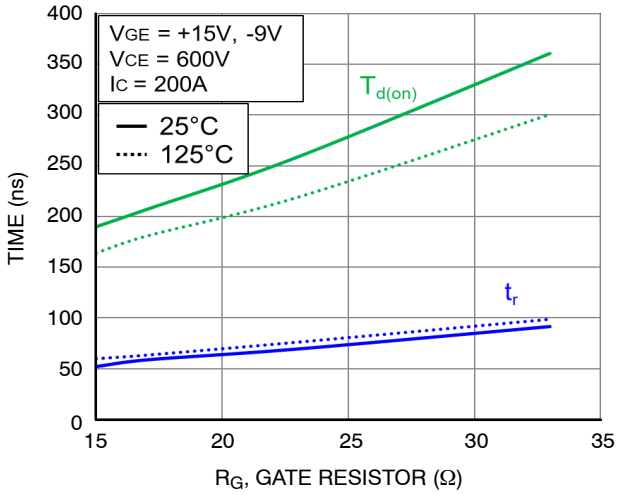


Figure 48. Typical Turn−On Switching Time vs. R_G

TYPICAL CHARACTERISTICS – T1↻D5A OR T4↻D6A (CONTINUED)

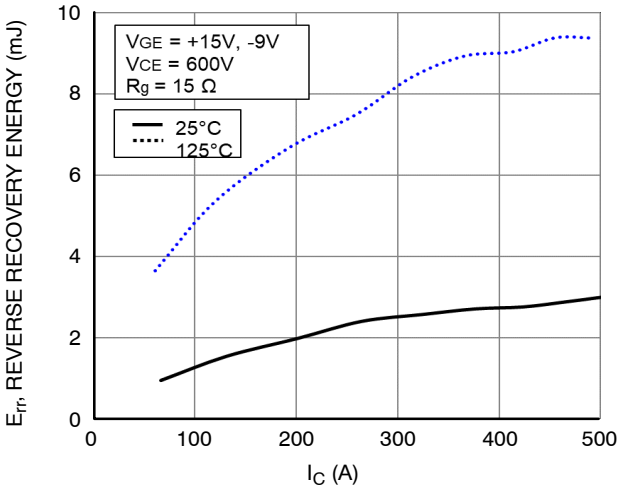


Figure 49. Typical Reverse Recovery Energy Loss vs. I_C

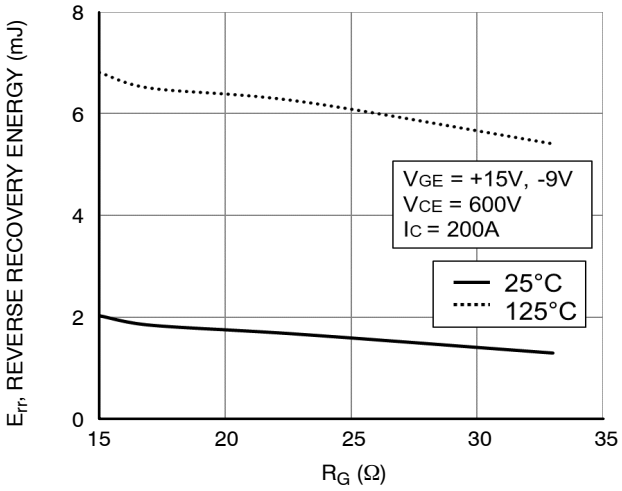


Figure 50. Typical Reverse Recovery Energy Loss vs. R_G

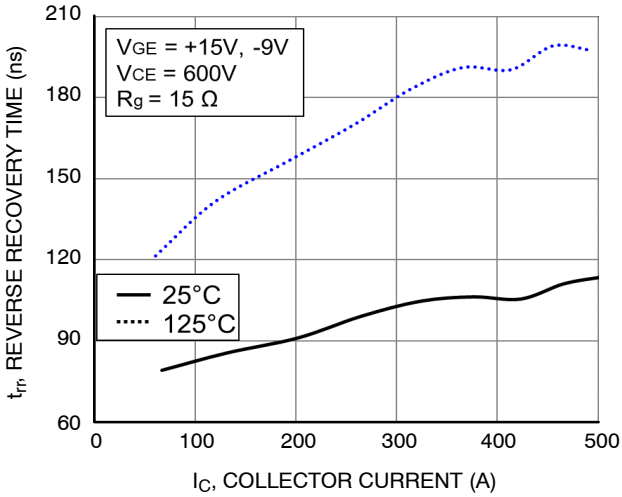


Figure 51. Typical Reverse Recovery Time vs. I_C

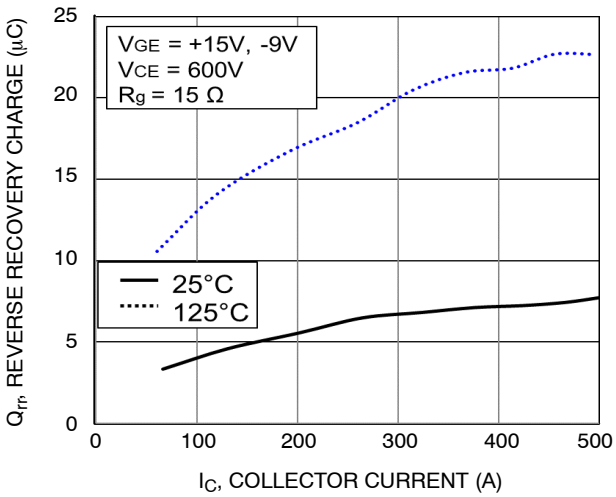


Figure 52. Typical Reverse Recovery Charge vs. I_C

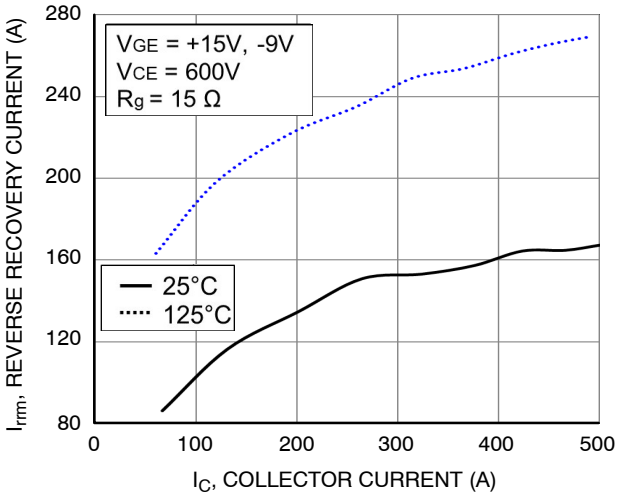


Figure 53. Typical Reverse Recovery Current vs. I_C

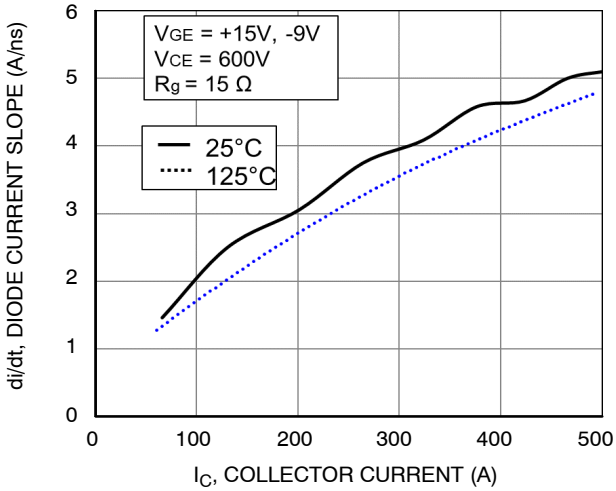


Figure 54. Typical di/dt vs. I_C

TYPICAL CHARACTERISTICS – T1↻D5A OR T4↻D6A (CONTINUED)

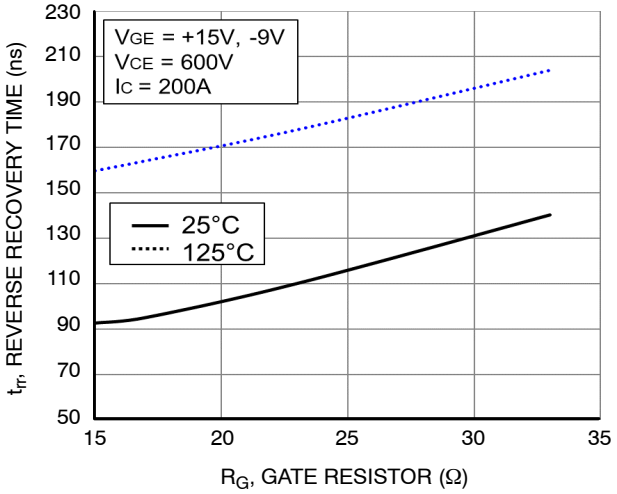


Figure 55. Typical Reverse Recovery Time vs. R_G

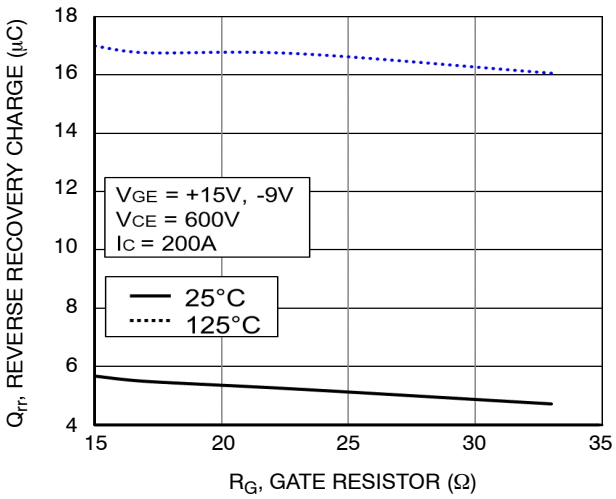


Figure 56. Typical Reverse Recovery Charge vs. R_G

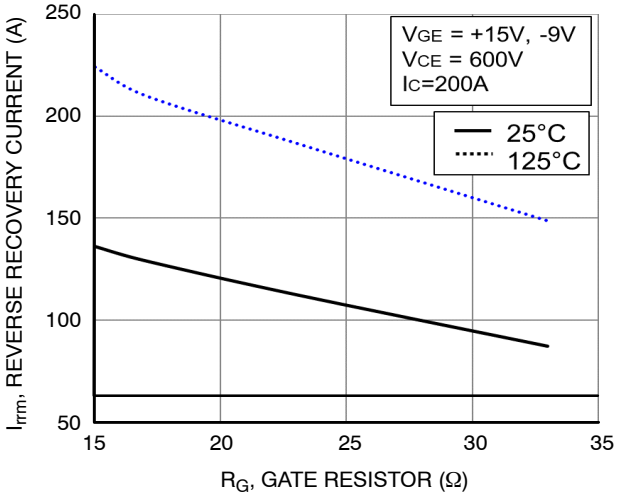


Figure 57. Typical Reverse Recovery Peak Current vs. R_G

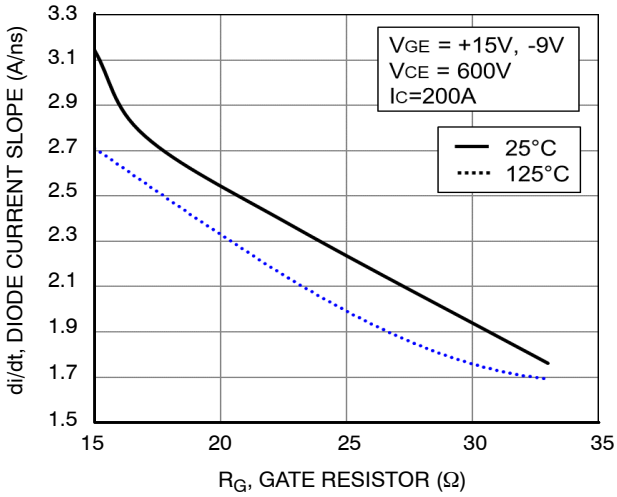


Figure 58. Typical di/dt vs. R_G

TYPICAL CHARACTERISTICS – T2↻D3A + D4A OR T3↻D1A + D2A

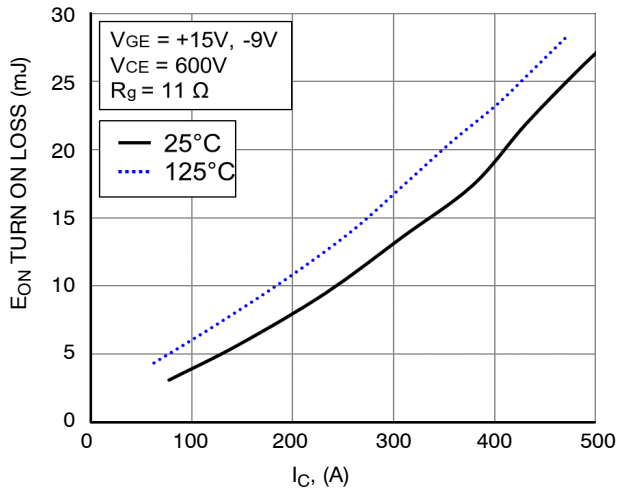


Figure 59. Typical Turn On Loss vs. I_C

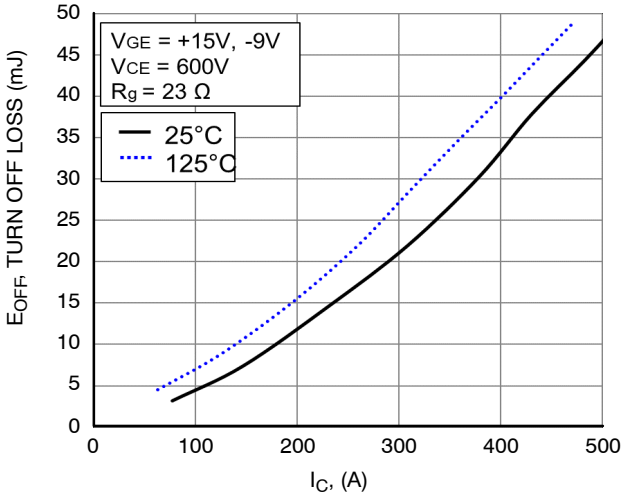


Figure 60. Typical Turn Off Loss vs. I_C

TYPICAL CHARACTERISTICS – T2↻D3A + D4A OR T3↻D1A + D2A (CONTINUED)

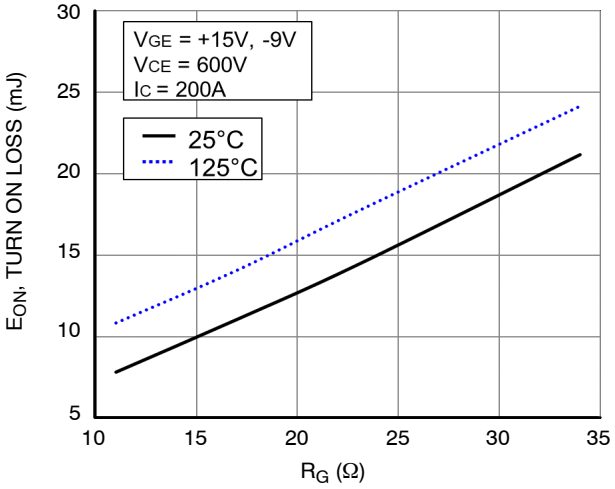


Figure 61. Typical Turn On Loss vs. R_G

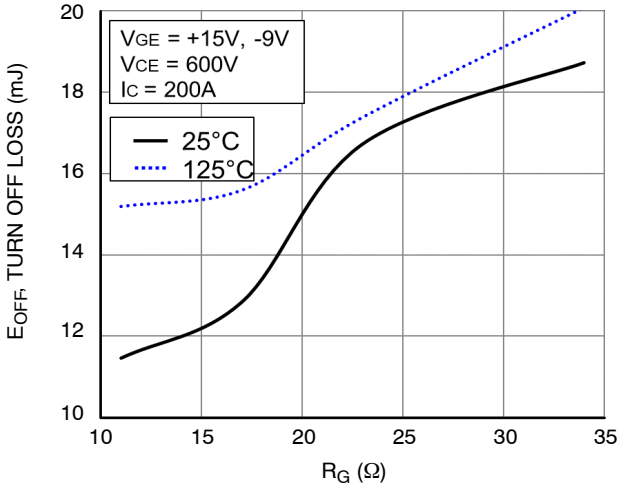


Figure 62. Typical Turn Off Loss vs. R_G

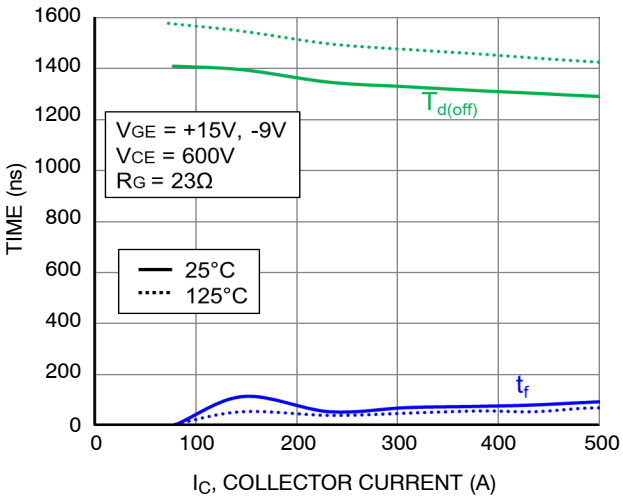


Figure 63. Typical Turn−Off Switching Time vs. I_C

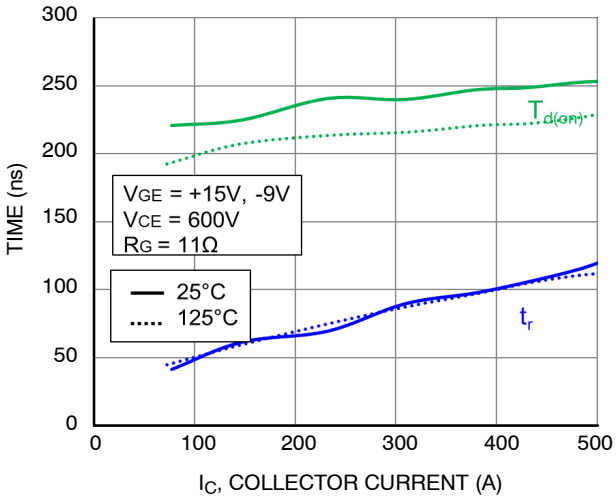


Figure 64. Typical Turn−On Switching Time vs. I_C

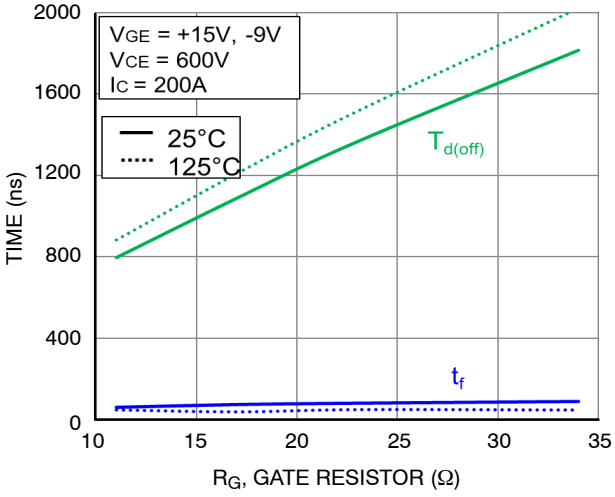


Figure 65. Typical Turn−Off Switching Time vs. R_G

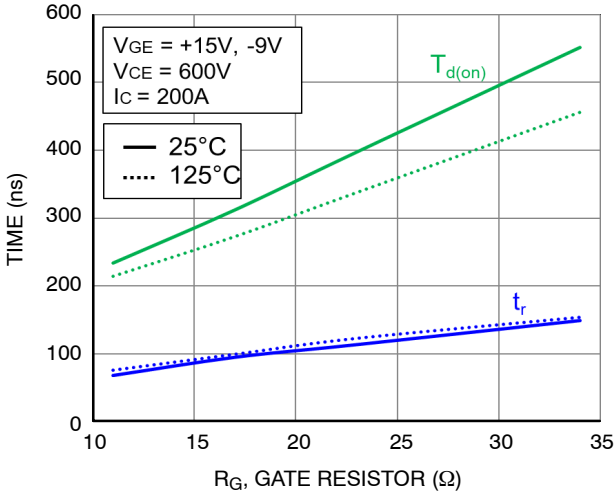


Figure 66. Typical Turn−On Switching Time vs. R_G

TYPICAL CHARACTERISTICS – T2ↄD3A + D4A OR T3ↄD1A + D2A (CONTINUED)

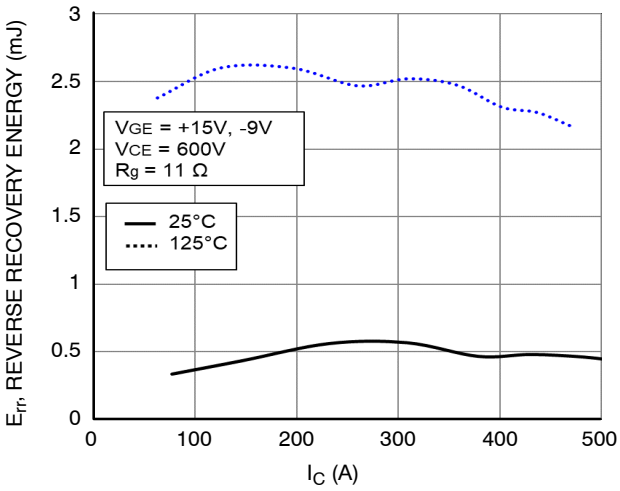


Figure 67. Typical Reverse Recovery Energy Loss vs. I_C

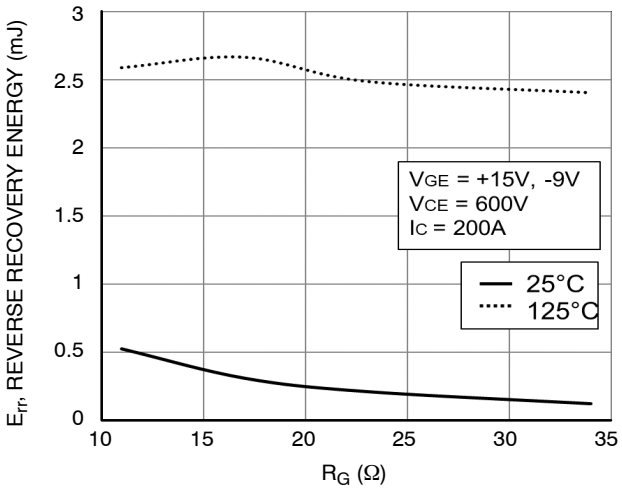


Figure 68. Typical Reverse Recovery Energy Loss vs. R_G

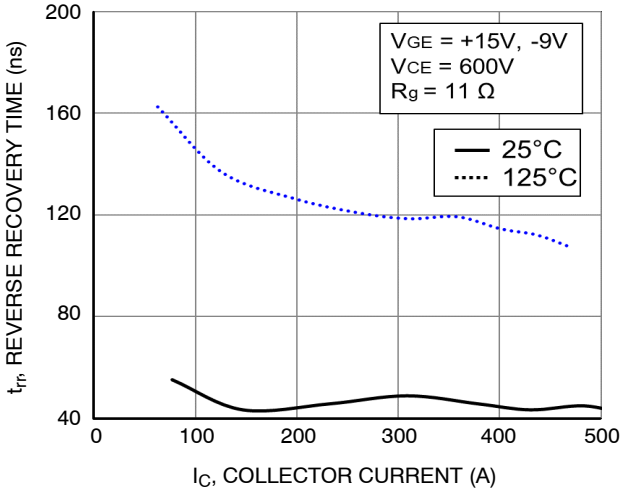


Figure 69. Typical Reverse Recovery Time vs. I_C

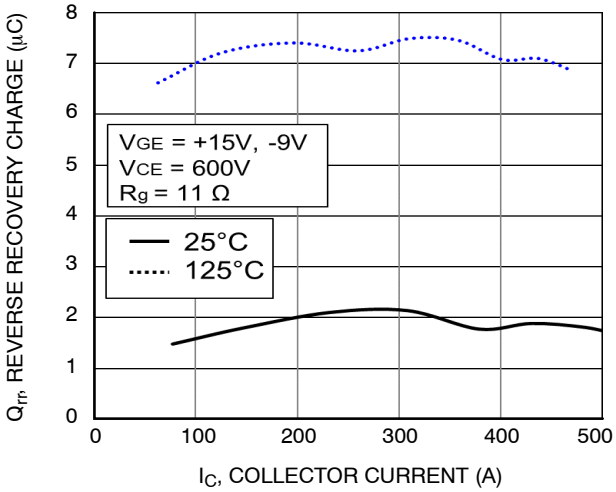


Figure 70. Typical Reverse Recovery Charge vs. I_C

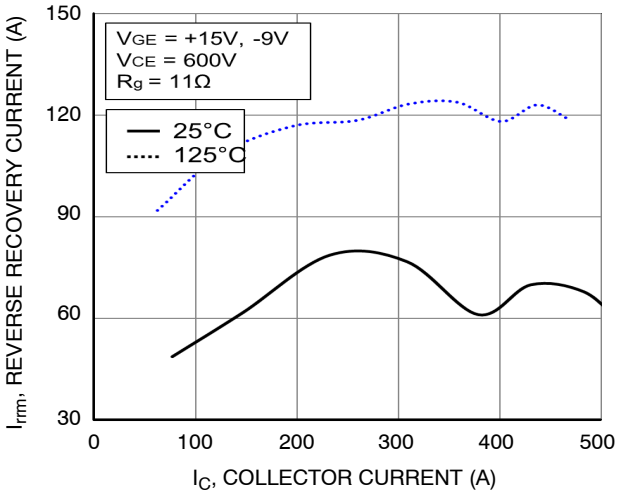


Figure 71. Typical Reverse Recovery Current vs. I_C

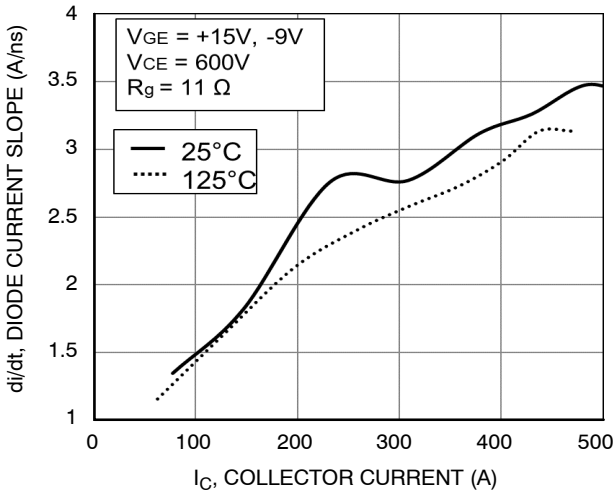


Figure 72. Typical di/dt vs. I_C

TYPICAL CHARACTERISTICS – T2↻D3A + D4A OR T3↻D1A + D2A (CONTINUED)

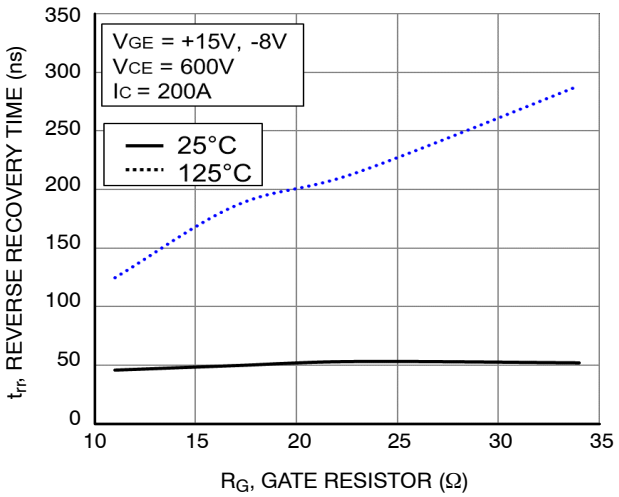


Figure 73. Typical Reverse Recovery Time vs. R_G

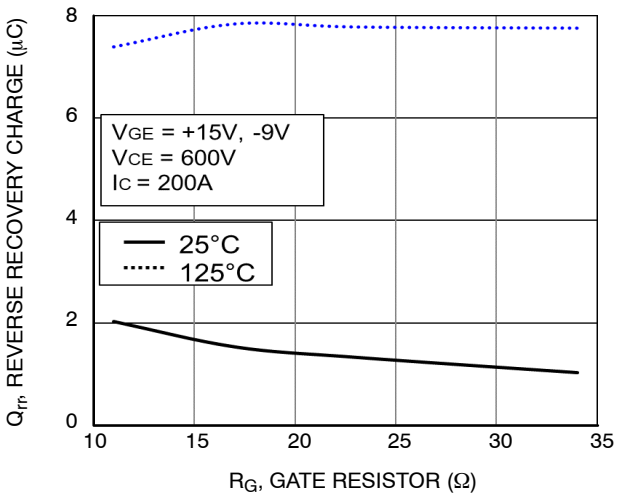


Figure 74. Typical Reverse Recovery Charge vs. R_G

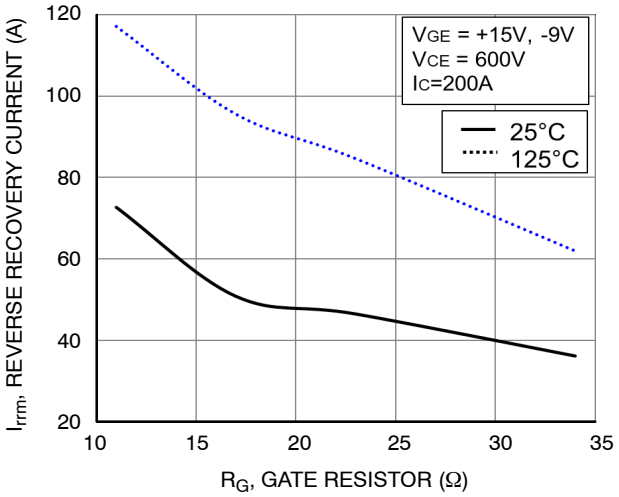


Figure 75. Typical Reverse Recovery Peak Current vs. R_G

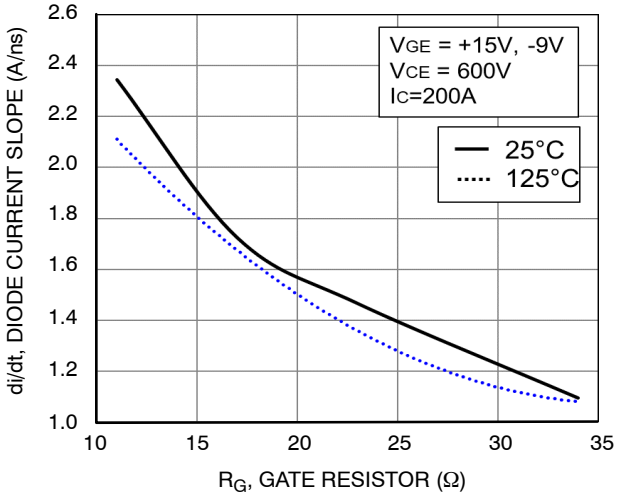


Figure 76. Typical di/dt vs. R_G

TYPICAL CHARACTERISTICS – T6↻D4A OR T5↻D1A

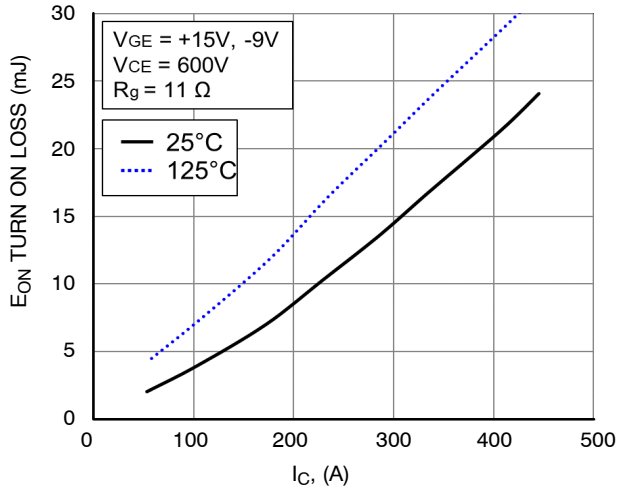


Figure 77. Typical Turn On Loss vs. I_C

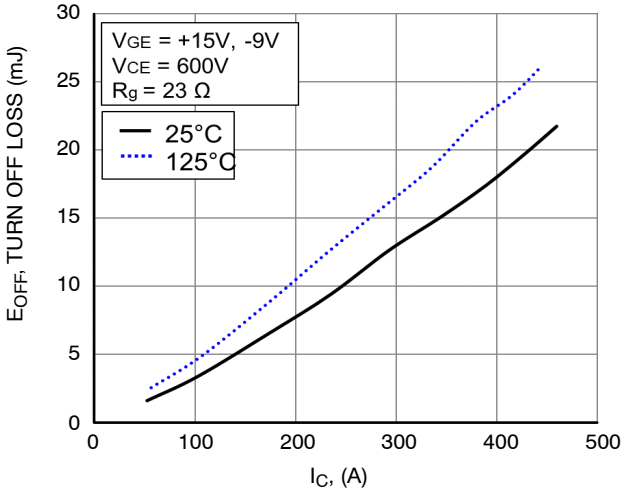


Figure 78. Typical Turn Off Loss vs. I_C

TYPICAL CHARACTERISTICS – T6ↄD4A OR T5ↄD1A (CONTINUED)

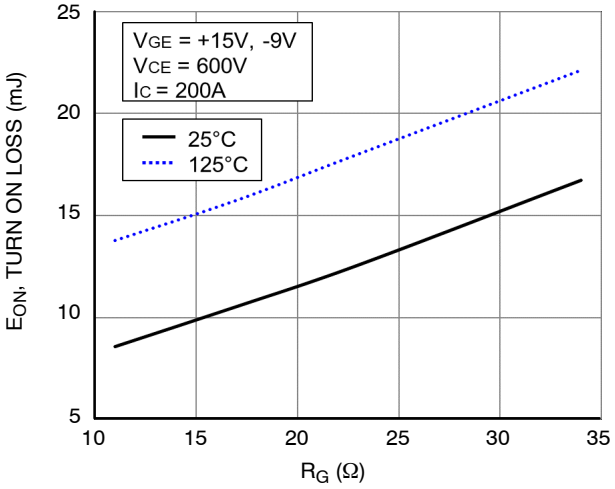


Figure 79. Typical Turn On Loss vs. R_G

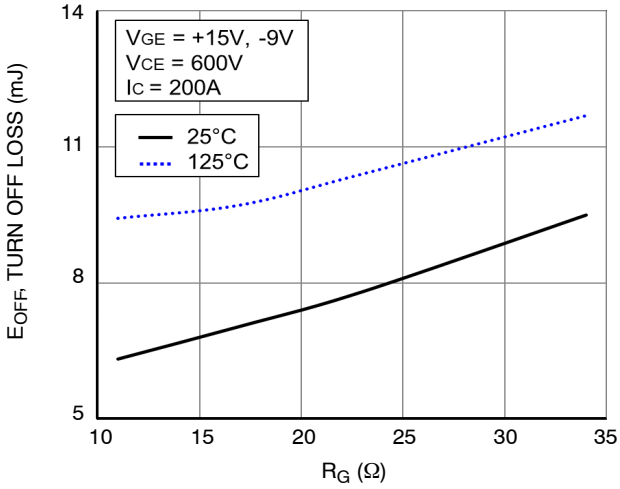


Figure 80. Typical Turn Off Loss vs. R_G

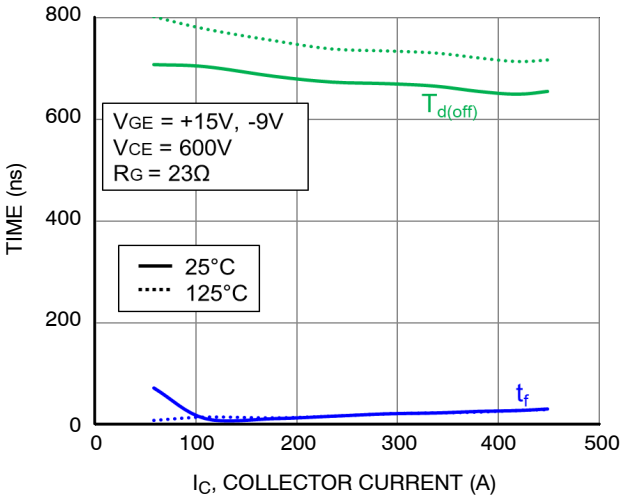


Figure 81. Typical Turn−Off Switching Time vs. I_C

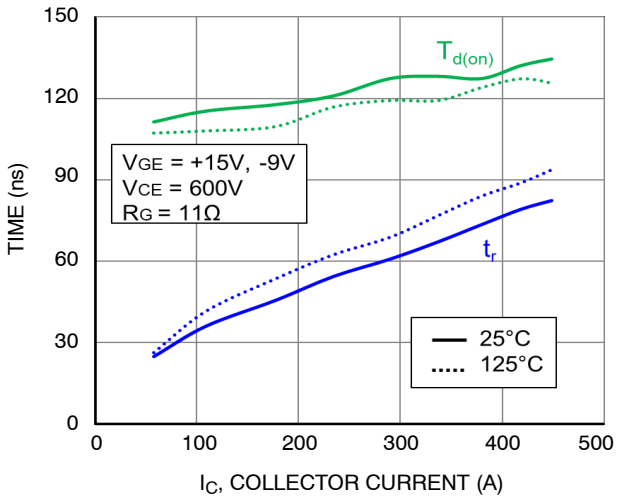


Figure 82. Typical Turn−On Switching Time vs. I_C

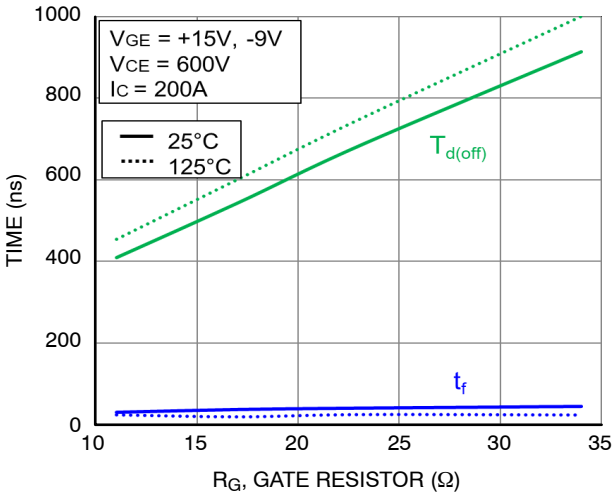


Figure 83. Typical Turn−Off Switching Time vs. R_G

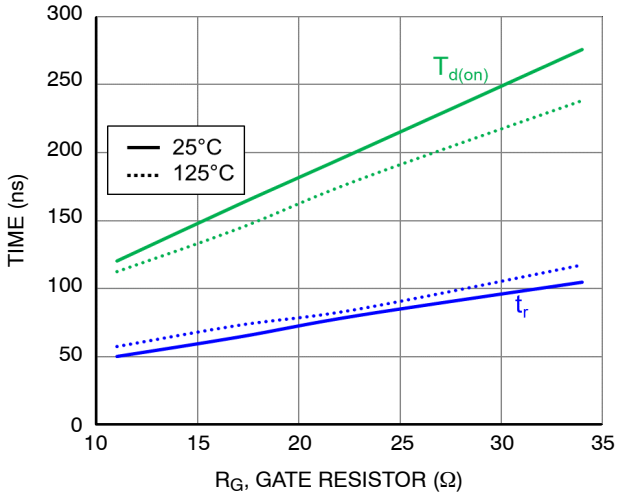


Figure 84. Typical Turn−On Switching Time vs. R_G

TYPICAL CHARACTERISTICS – T6‿D4A OR T5‿D1A (CONTINUED)

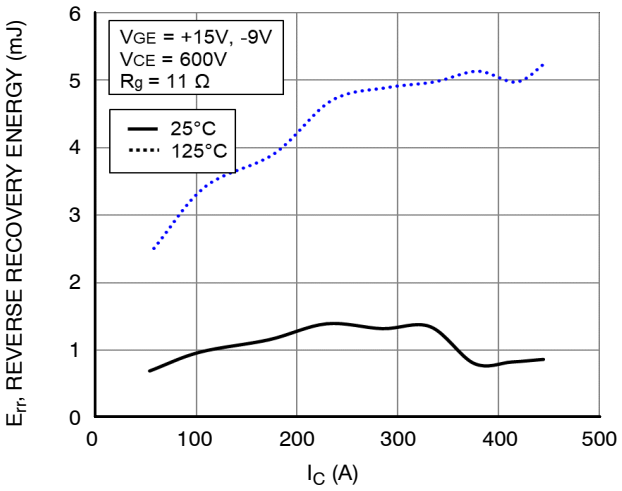


Figure 85. Typical Reverse Recovery Energy Loss vs. I_C

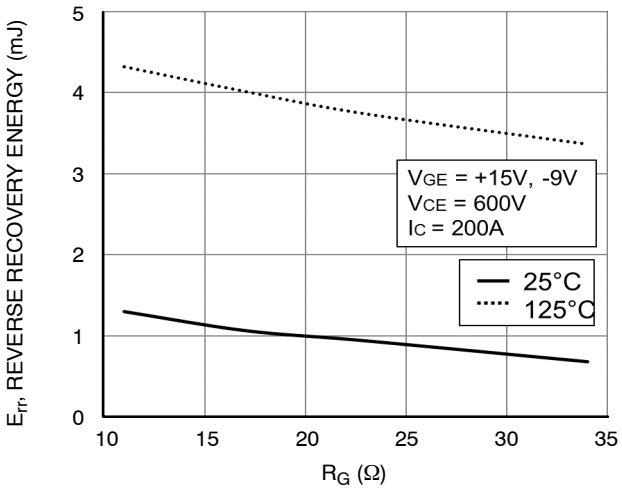


Figure 86. Typical Reverse Recovery Energy Loss vs. R_G

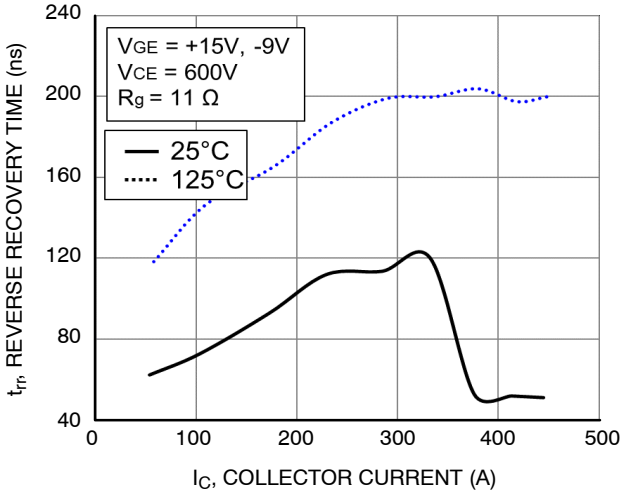


Figure 87. Typical Reverse Recovery Time vs. I_C

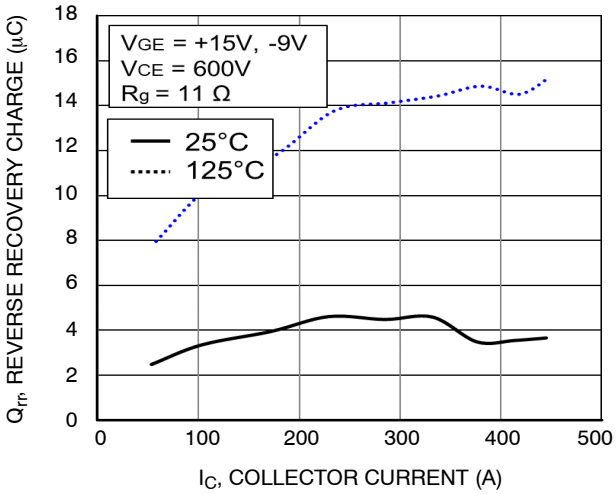


Figure 88. Typical Reverse Recovery Charge vs. I_C

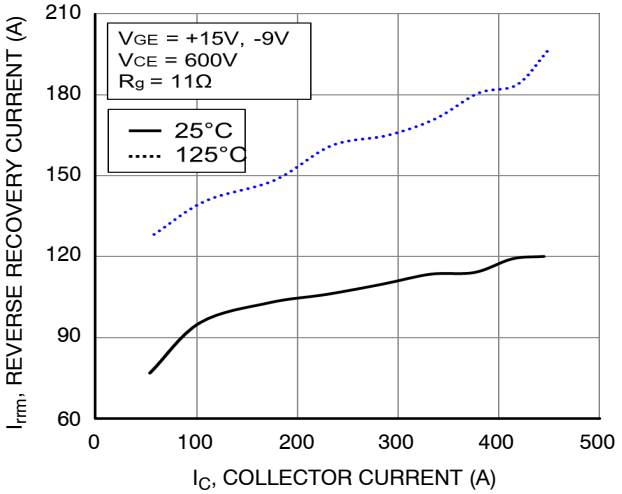


Figure 89. Typical Reverse Recovery Current vs. I_C

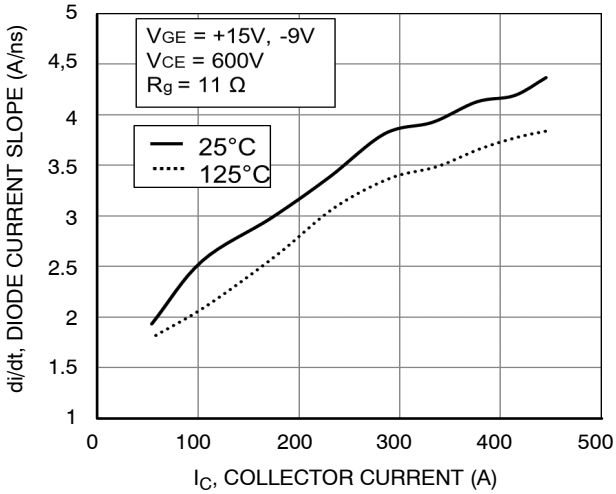


Figure 90. Typical di/dt vs. I_C

TYPICAL CHARACTERISTICS – T6‿D4A OR T5‿D1A (CONTINUED)

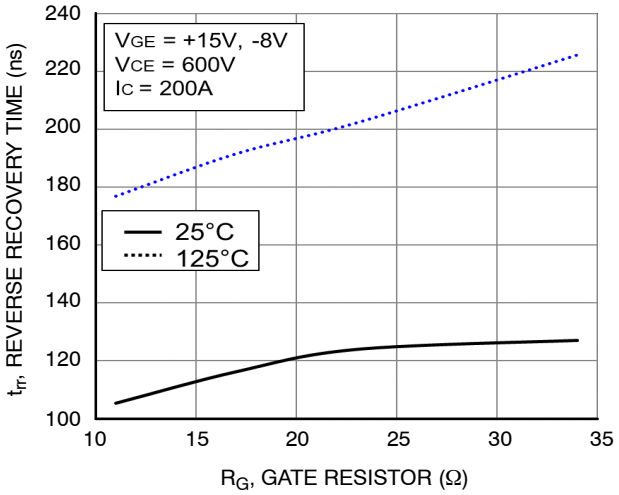


Figure 91. Typical Reverse Recovery Time vs. R_G

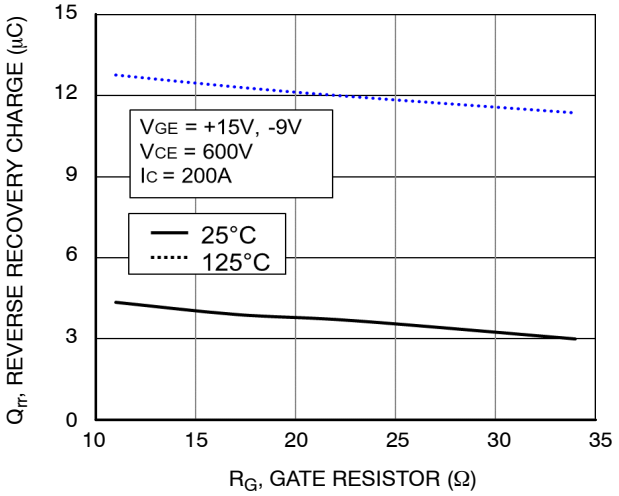


Figure 92. Typical Reverse Recovery Charge vs. R_G

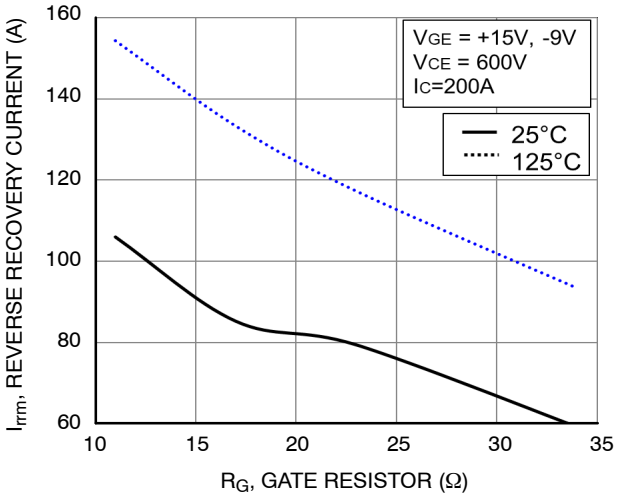


Figure 93. Typical Reverse Recovery Peak Current vs. R_G

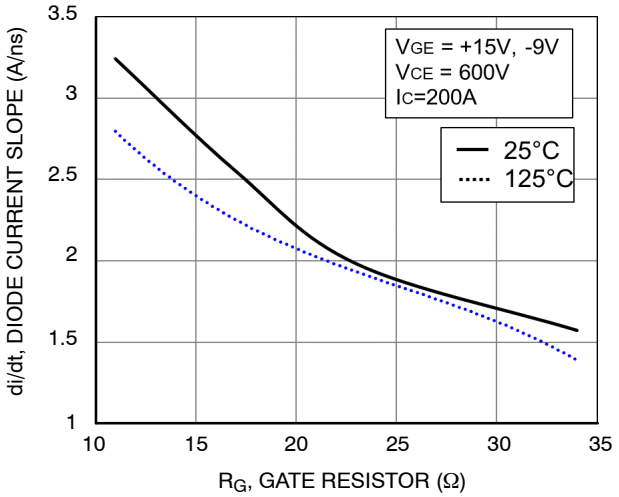
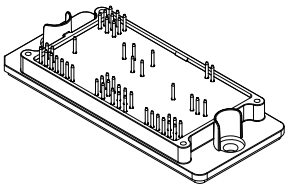


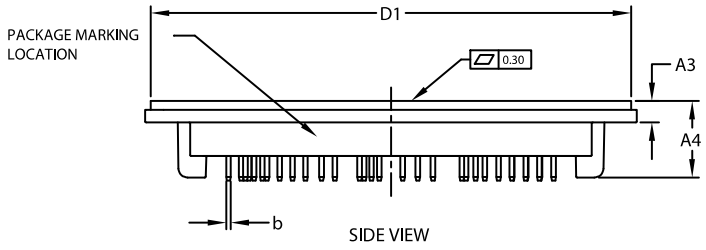
Figure 94. Typical di/dt vs. R_G

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

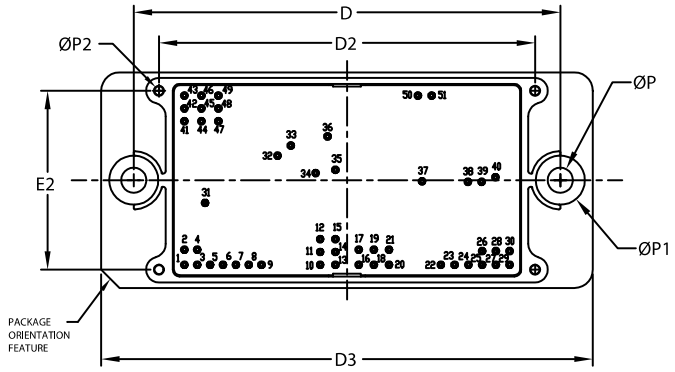
PIM51, 93x47 (SOLDER PIN)
CASE 180BM
ISSUE O

DATE 27 OCT 2021

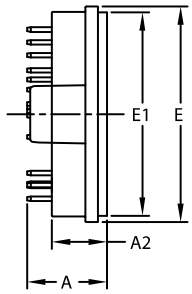




SIDE VIEW



TOP VIEW

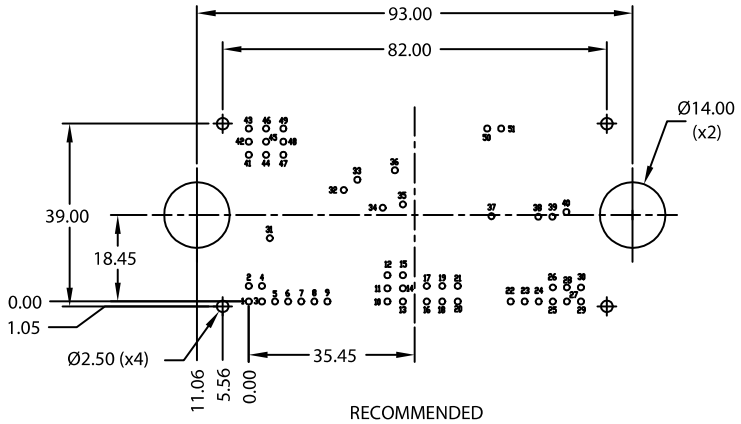


END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES

	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	17.00	17.40	17.80
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	0.95	1.00	1.05
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20



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, SOLDERRM/D.

NOTE 4

	PIN POSITION			PIN POSITION	
PIN	X	Y	PIN	X	Y
1	0.00	0.00	27	67.90	0.00
2	0.00	3.30	28	67.90	3.00
3	2.80	0.00	29	70.90	0.00
4	2.80	3.30	30	70.90	3.00
5	5.60	0.00	31	4.50	13.50
6	8.40	0.00	32	20.30	23.80
7	11.20	0.00	33	23.20	26.00
8	14.00	0.00	34	28.60	20.00
9	16.80	0.00	35	32.90	20.70
10	29.60	0.00	36	31.20	28.00
11	29.60	2.80	37	51.80	18.20
12	29.60	5.60	38	61.80	18.10
13	32.90	0.00	39	64.80	18.10
14	32.90	2.80	40	67.80	19.10
15	32.90	5.60	41	0.00	31.30
16	38.00	0.00	42	0.00	34.10
17	38.00	3.30	43	0.00	36.90
18	41.30	0.00	44	3.70	31.30
19	41.30	3.30	45	3.70	34.10
20	44.60	0.00	46	3.70	36.90
21	44.60	3.30	47	7.40	31.30
22	55.90	0.00	48	7.40	34.10
23	58.90	0.00	49	7.40	36.90
24	61.90	0.00	50	50.90	36.90
25	64.90	0.00	51	53.90	36.90
26	64.90	3.00			

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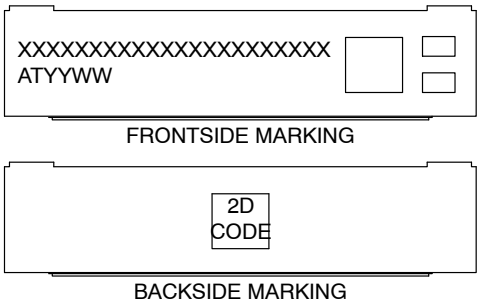
DESCRIPTION:	**PIM51 93X47 (SOLDER PIN)**	**PAGE 1 OF 2**

PIM51, 93x47 (SOLDER PIN)
CASE 180BM
ISSUE O

DATE 27 OCT 2021

GENERIC
MARKING DIAGRAM*



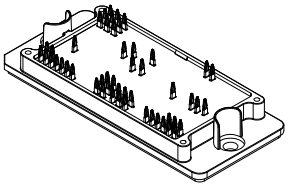
XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

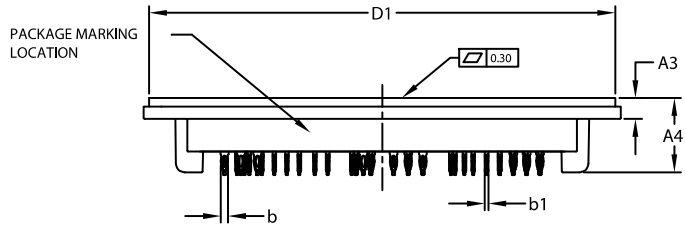
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

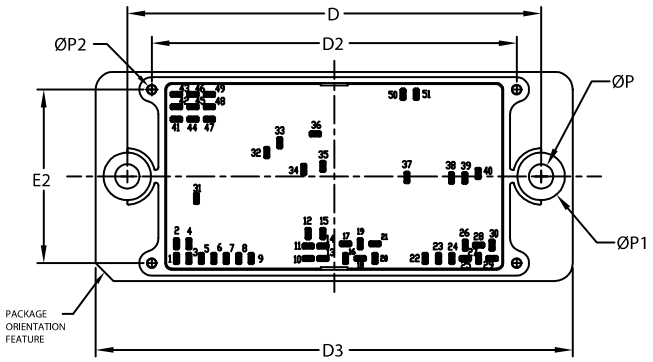
PIM51, 93x47 (PRESS FIT)
CASE 180CQ
ISSUE O

DATE 28 OCT 2021

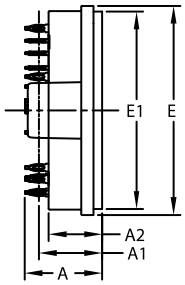




SIDE VIEW



TOP VIEW

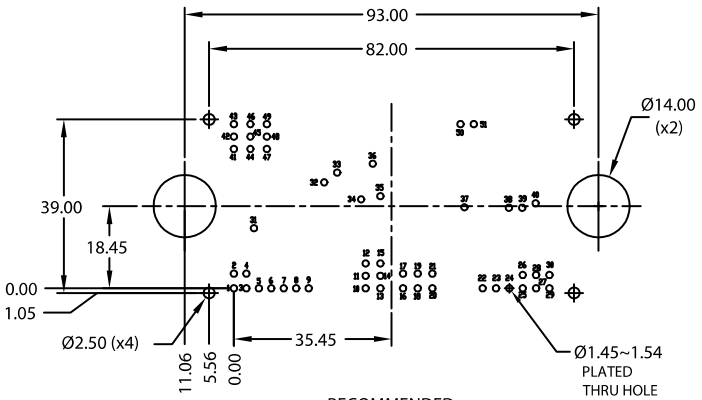


END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES

	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	16.90	17.30	17.70
A1	14.18(REF)		
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	1.61	1.66	1.71
b1	0.75	0.80	0.85
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20



RECOMMENDED
MOUNTING PATTERN

NOTE 4

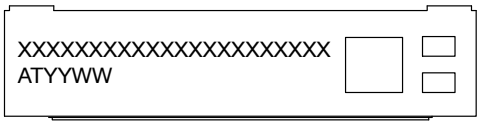
	PIN POSITION			PIN POSITION	
PIN	X	Y	PIN	X	Y
1	0.00	0.00	27	67.90	0.00
2	0.00	3.30	28	67.90	3.00
3	2.80	0.00	29	70.90	0.00
4	2.80	3.30	30	70.90	3.00
5	5.60	0.00	31	4.50	13.50
6	8.40	0.00	32	20.30	23.80
7	11.20	0.00	33	23.20	26.00
8	14.00	0.00	34	28.60	20.00
9	16.80	0.00	35	32.90	20.70
10	29.60	0.00	36	31.20	28.00
11	29.60	2.80	37	51.80	18.20
12	29.60	5.60	38	61.80	18.10
13	32.90	0.00	39	64.80	18.10
14	32.90	2.80	40	67.80	19.10
15	32.90	5.60	41	0.00	31.30
16	38.00	0.00	42	0.00	34.10
17	38.00	3.30	43	0.00	36.90
18	41.30	0.00	44	3.70	31.30
19	41.30	3.30	45	3.70	34.10
20	44.60	0.00	46	3.70	36.90
21	44.60	3.30	47	7.40	31.30
22	55.90	0.00	48	7.40	34.10
23	58.90	0.00	49	7.40	36.90
24	61.90	0.00	50	50.90	36.90
25	64.90	0.00	51	53.90	36.90
26	64.90	3.00			

DOCUMENT NUMBER:	**98AON39256H**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**PIM51 93X47 (PRESS FIT)**	**PAGE 1 OF 2**

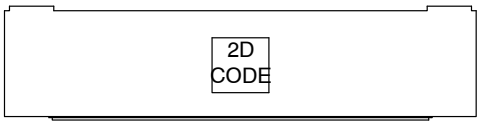
PIM51, 93x47 (PRESS FIT)
CASE 180CQ
ISSUE O

DATE 30 OCT 2021

GENERIC
MARKING DIAGRAM*



FRONTSIDE MARKING



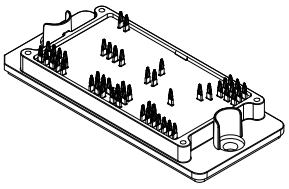
BACKSIDE MARKING

XXXXX = Specific Device 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.

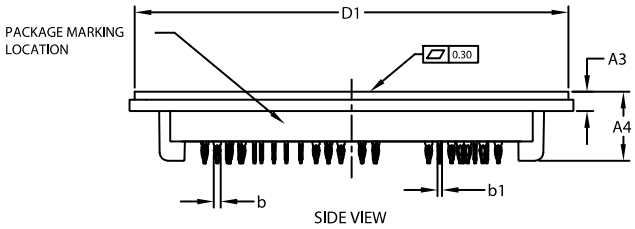
DOCUMENT NUMBER:	**98AON39256H**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**PIM51 93X47 (PRESS FIT)**	**PAGE 2 OF 2**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

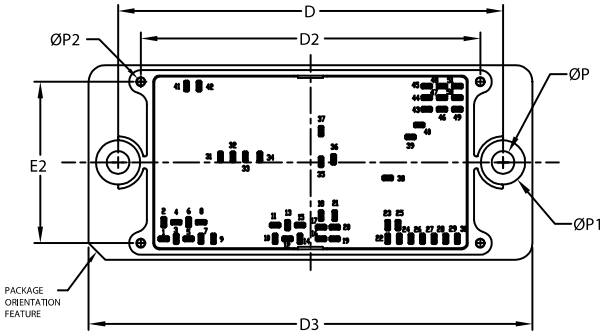


PIM51, 93x47 (PRESS FIT)
CASE 180HG
ISSUE O

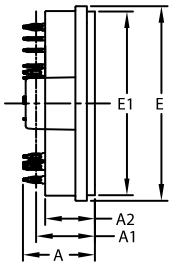
DATE 10 NOV 2021



SIDE VIEW



TOP VIEW

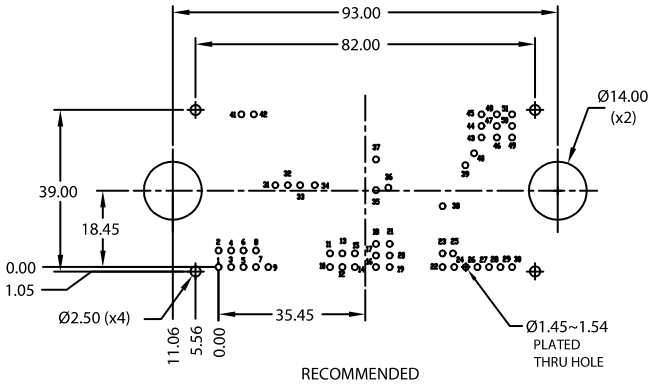


END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	16.90	17.30	17.70
A1	14.18(REF)		
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	1.61	1.66	1.71
b1	0.75	0.80	0.85
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20



RECOMMENDED
MOUNTING PATTERN

NOTE 4

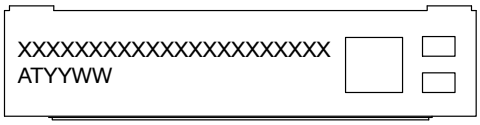
PIN	PIN POSITION		PIN	PIN POSITION	
	X	Y		X	Y
1	0.00	0.00	27	62.50	0.00
2	0.00	4.00	28	65.30	0.00
3	3.00	0.00	29	68.10	0.00
4	3.00	4.00	30	70.90	0.00
5	6.00	0.00	31	13.70	19.80
6	6.00	4.00	32	16.70	19.80
7	9.00	0.00	33	19.70	19.80
8	9.00	4.00	34	23.20	19.80
9	12.00	0.00	35	38.00	18.60
10	26.90	0.00	36	41.00	19.20
11	26.90	3.30	37	38.00	26.00
12	29.90	0.00	38	54.10	14.70
13	29.90	3.30	39	59.60	24.60
14	32.90	0.00	40	61.70	27.50
15	32.90	3.30	41	5.50	36.90
16	38.00	0.00	42	8.50	36.90
17	38.00	2.80	43	63.50	31.30
18	38.00	5.60	44	63.50	34.10
19	41.30	0.00	45	63.50	36.90
20	41.30	2.80	46	67.20	31.30
21	41.30	5.60	47	67.20	34.10
22	54.10	0.00	48	67.20	36.90
23	54.10	3.30	49	70.90	31.30
24	56.90	0.00	50	70.90	34.10
25	56.60	3.30	51	70.90	36.90
26	59.70	0.00			

DOCUMENT NUMBER:	98AON39438H	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	PIM51 93X47 (PRESS FIT)	PAGE 1 OF 2

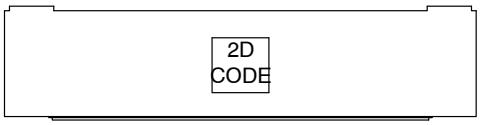
PIM51, 93x47 (PRESS FIT)
CASE 180HG
ISSUE O

DATE 08 NOV 2021

GENERIC
MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

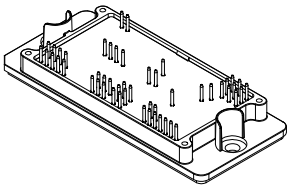
XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

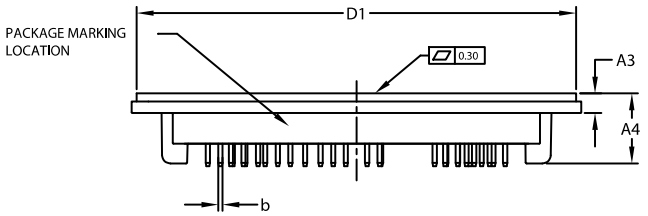
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

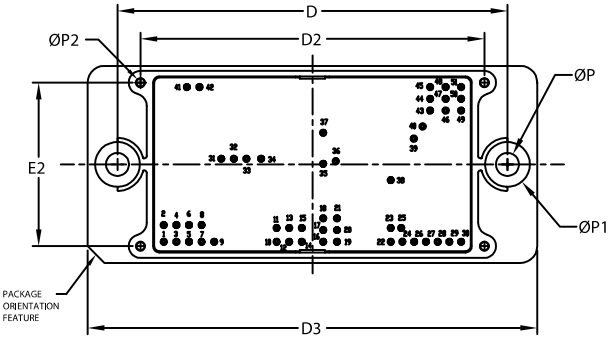
PIM51, 93x47 (SOLDER PIN)
CASE 180HH
ISSUE O

DATE 16 NOV 2021

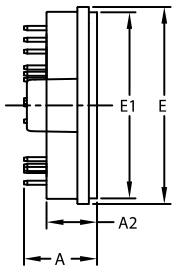




SIDE VIEW



TOP VIEW

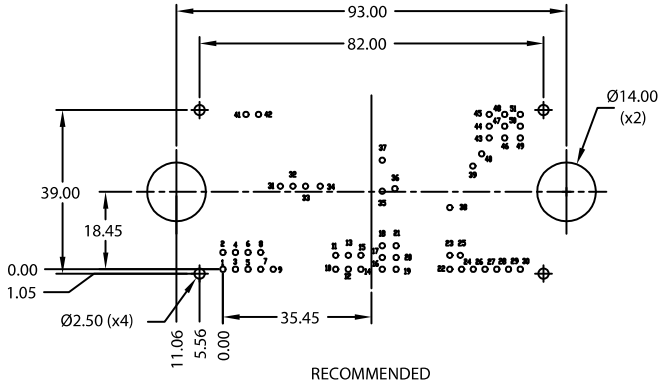


END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES

	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	17.00	17.40	17.80
A2	11.70	12.00	12.30
A3	4.40	4.70	5.00
A4	16.40	16.70	17.00
b	0.95	1.00	1.05
D	92.90	93.00	93.10
D1	104.45	104.75	105.05
D2	81.80	82.00	82.20
D3	106.90	107.20	107.50
E	46.70	47.00	47.30
E1	44.10	44.40	44.70
E2	38.80	39.00	39.20
P	5.40	5.50	5.60
P1	10.60	10.70	10.80
P2	1.80	2.00	2.20



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, SOLDERRM/D.**

NOTE 4

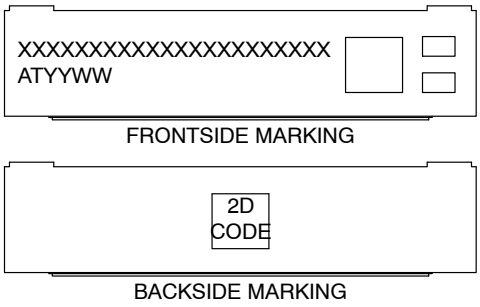
	PIN POSITION			PIN POSITION	
PIN	X	Y	PIN	X	Y
1	0.00	0.00	27	62.50	0.00
2	0.00	4.00	28	65.30	0.00
3	3.00	0.00	29	68.10	0.00
4	3.00	4.00	30	70.90	0.00
5	6.00	0.00	31	13.70	19.80
6	6.00	4.00	32	16.70	19.80
7	9.00	0.00	33	19.70	19.80
8	9.00	4.00	34	23.20	19.80
9	12.00	0.00	35	38.00	18.60
10	26.90	0.00	36	41.00	19.20
11	26.90	3.30	37	38.00	26.00
12	29.90	0.00	38	54.10	14.70
13	29.90	3.30	39	59.60	24.60
14	32.90	0.00	40	61.70	27.50
15	32.90	3.30	41	5.50	36.90
16	38.00	0.00	42	8.50	36.90
17	38.00	2.80	43	63.50	31.30
18	38.00	5.60	44	63.50	34.10
19	41.30	0.00	45	63.50	36.90
20	41.30	2.80	46	67.20	31.30
21	41.30	5.60	47	67.20	34.10
22	54.10	0.00	48	67.20	36.90
23	54.10	3.30	49	70.90	31.30
24	56.90	0.00	50	70.90	34.10
25	56.60	3.30	51	70.90	36.90
26	59.70	0.00			

DOCUMENT NUMBER:	**98AON39619H**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**PIM51 93X47 (SOLDER PIN)**	**PAGE 1 OF 2**

PIM51, 93x47 (SOLDER PIN)
CASE 180HH
ISSUE O

DATE 16 NOV 2021

GENERIC
MARKING DIAGRAM*



XXXXX = Specific Device 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.

ADDITIONAL INFORMATION

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