Q2PACK Module

SNXH100M95L3Q2F2PG

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
- Q2PACK Package with Press−Fit Pins

Typical Applications

- Solar Inverters
- UPS Systems

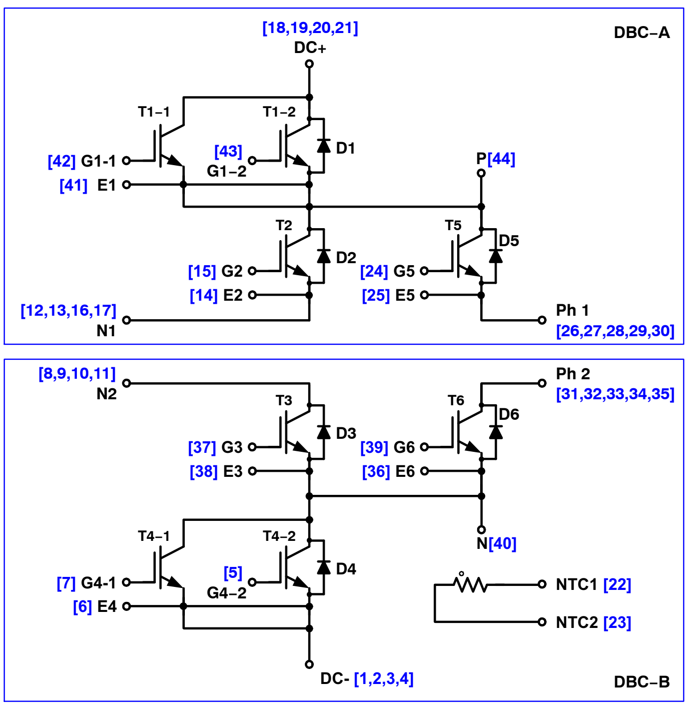
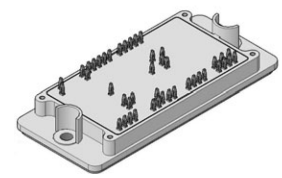
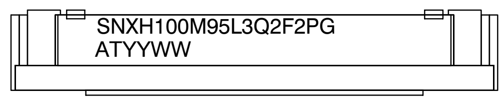


Figure 1. Schematic of Q2PACK



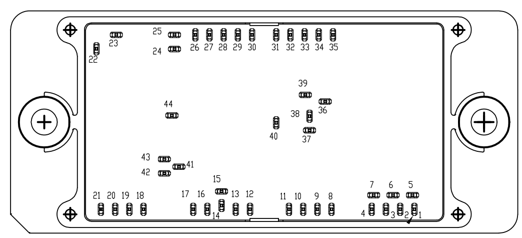
Q2PACK MODULE
CASE 180AW

MARKING DIAGRAM



G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year & Work Week Code

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
SNXH100M95L3Q2F2PG (GenIII − Q2PACK, Press−fit Pin)	Q2PACK (Pb−Free)	12 Units / Blister Tray

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IGBT (T1–1, T1–2, T4–1, T4–2)			
Collector–emitter Voltage	V_{CES}	950	V
Collector Current @ T_h = 80°C	I_C	108	A
Pulsed Peak Collector Current @ T_{pulse} =1 ms	I_{CM}	324	A
Power Dissipation per IGBT T_J = T_{Jmax} T_h = 80°C	P_{tot}	221	W
Gate–emitter Voltage Positive transient gate–emitter voltage (Tpulse = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Maximum Junction Temperature (Note 1)	T_J	175	°C
IGBT (T2, T3)			
Collector–emitter Voltage	V_{CES}	950	V
Collector Current @ T_h = 80°C	I_C	108	A
Pulsed Peak Collector Current @ T_{pulse} =1 ms	I_{CM}	324	A
Power Dissipation per IGBT T_J = T_{Jmax} T_h = 80°C	P_{tot}	221	W
Gate–emitter Voltage Positive transient gate–emitter voltage	V_{GE}	±20 30	V
Maximum Junction Temperature (Note 1)	T_J	175	°C
IGBT (T5, T6)			
Collector–emitter Voltage	V_{CES}	950	V
Collector Current @ T_h = 80°C	I_C	245	A
Pulsed Peak Collector Current @ T_{pulse} =1 ms	I_{CM}	735	A
Power Dissipation per IGBT T_J = T_{Jmax} T_h = 80°C	P_{tot}	405	W
Gate–emitter Voltage Positive transient gate–emitter voltage (Tpulse = 5 μs, D < 0.10)	V_{GE}	±20 30	V
Maximum Junction Temperature (Note 1)	T_J	175	°C
IGBT INVERSE DIODE (D1, D2, D3, D4, D5, D6)			
Peak Repetitive Reverse Voltage	V_{RRM}	950	V
Forward Current, DC @ T_h = 80°C	I_F	111	A
Repetitive Peak Forward Current, Tpulse = 1 ms	I_{FSM}	333	A
Power Dissipation (T_J = T_{Jmax}, T_h = 80°C)	P_{tot}	240	W
Maximum Junction Temperature (Note 1)	T_J	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.
1. Rated per discrete TO247 qualification.

THERMAL PROPERTIES

Parameter	Symbol	Value	Unit
Operating Temperature under Switching Condition	$T_{VJ\ OP}$	–40 to (T_{Jmax} – 25)	°C
Storage Temperature Range	T_{stg}	–40 to +125	°C

INSULATION PROPERTIES

Parameter	Symbol	Value	Unit
Isolation Test Voltage, t = 1 min, 50/60 Hz	V_{is}	3400	V_{RMS}
Creepage Distance		12.7	mm
Comparative tracking index	CTI	> 600	

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T1−1, T1−2, T4−1, T4−2)						
Collector−emitter Breakdown Volt age	V_{GE} = 0 V, I_C = 1.7 mA	$V_{(BR)CES}$	950	–	–	V
Collector−emitter Saturation Voltage (pin−to−pin)	V_{GE} = 15 V, I_C = 150 A, T_J = 25°C V_{GE} = 15 V, I_C = 150 A, T_J = 150°C	$V_{CE(sat)}$	– –	1.85 2.25	2.4 –	V
Gate−emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 150mA	$V_{GE(TH)}$	4.1	4.7	5.7	V
Collector−emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 950 V	I_{CES}	–	–	400	µA
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	800	nA
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 10 kHz	C_{ies}	–	9546	–	pF
Output Capacitance		C_{oes}	–	241	–	
Reverse Transfer Capacitance		C_{res}	–	54	–	
Gate Charge Total	V_{CE} = 600 V, I_C = 150 A, V_{GE} =15 V	Q_g	–	285	–	nC
Thermal Resistance − Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.43	–	°C/W
IGBT (T1, T4)						
Turn−on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 75 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	103	–	ns
Rise Time		t_r	–	49	–	
Turn−off Delay Time		$t_{d(off)}$	–	1495	–	
Fall Time		t_f	–	71	–	
Turn On Switching Loss		E_{on}	–	5.58	–	mJ
Turn Off Switching Loss		E_{off}	–	6.54	–	
Turn−on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 100 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	82	–	ns
Rise Time		t_r	–	54	–	
Turn−off Delay Time		$t_{d(off)}$	–	1754	–	
Fall Time		t_f	–	118	–	
Turn On Switching Loss		E_{on}	–	7.14	–	mJ
Turn Off Switching Loss		E_{off}	–	9.36	–	
IGBT (T2, T3)						
Collector−emitter Breakdown Volt age	V_{GE} = 0 V, I_C = 1.35 mA	$V_{(BR)CES}$	950	–	–	V
Collector−emitter Saturation Voltage (pin−to−pin)	V_{GE} = 15 V, I_C = 150 A, T_J = 25°C V_{GE} = 15 V, I_C = 150 A, T_J = 150°C	$V_{CE(sat)}$	– –	1.85 2.25	2.4 –	V
Gate−emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 150 mA	$V_{GE(TH)}$	4.1	4.7	5.7	V
Collector−emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 950 V	I_{CES}	–	–	200	µA
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	800	nA
Turn−on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 75 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	66	–	ns
Rise Time		t_r	–	38	–	
Turn−off Delay Time		$t_{d(off)}$	–	735	–	
Fall Time		t_f	–	22	–	
Turn On Switching Loss		E_{on}	–	3.5	–	mJ
Turn Off Switching Loss		E_{off}	–	3.2	–	

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT (T2, T3)						
Turn−on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 100 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	$t_{d(on)}$	–	56	–	ns
Rise Time		t_r	–	41	–	
Turn−off Delay Time		$t_{d(off)}$	–	849	–	
Fall Time		t_f	–	33	–	
Turn On Switching Loss		E_{on}	–	6.3	–	mJ
Turn Off Switching Loss		E_{off}	–	5.5	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 10 kHz	C_{ies}	–	9546	–	pF
Output Capacitance		C_{oes}	–	241	–	
Reverse Transfer Capacitance		C_{res}	–	54	–	
Gate Charge Total	V_{CE} = 600 V, I_C = 150 A, V_{GE} =15 V	Q_g	–	285	–	nC
Thermal Resistance – Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.43	–	°C/W
IGBT (T5, T6)						
Collector−emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 1.55 mA	$V_{(BR)CES}$	950	–	–	V
Collector−emitter Saturation Voltage (pin−to−pin)	V_{GE} = 15 V, I_C = 225 A, T_J = 25°C V_{GE} = 15 V, I_C = 225 A, T_J = 150°C	$V_{CE(sat)}$	– –	1.33 1.55	1.75 –	V
Gate−emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 300 mA	$V_{GE(TH)}$	4.1	4.72	5.7	V
Collector−emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 950 V	I_{CES}	–	–	400	μA
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	1.6	μA
Turn−on Delay Time	T_J = 25°C V_{CE} = 600 V, I_C = 75 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 50 Ω $R_{G(off)}$ = 60 Ω	$t_{d(on)}$	–	296	–	ns
Rise Time		t_r	–	121	–	
Turn−off Delay Time		$t_{d(off)}$	–	1842	–	
Fall Time		t_f	–	65	–	
Turn On Switching Loss		E_{on}	–	7.38	–	mJ
Turn Off Switching Loss		E_{off}	–	9.1	–	
Turn−on Delay Time	T_J = 125°C V_{CE} = 600 V, I_C = 100 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 50 Ω $R_{G(off)}$ = 60 Ω	$t_{d(on)}$	–	274	–	ns
Rise Time		t_r	–	129	–	
Turn−off Delay Time		$t_{d(off)}$	–	2068	–	
Fall Time		t_f	–	80	–	
Turn On Switching Loss		E_{on}	–	10.8	–	mJ
Turn Off Switching Loss		E_{off}	–	15.4	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 10 kHz	C_{ies}	–	19132	–	pF
Output Capacitance		C_{oes}	–	472	–	
Reverse Transfer Capacitance		C_{res}	–	106	–	
Gate Charge Total	V_{CE} = 600 V, I_C = 225 A, V_{GE} = 15 V	Q_g	–	540	–	nC
Thermal Resistance – Chip−to−Heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.23	–	°C/W

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

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
IGBT INVERSE DIODE (D1, D2, D3, D4, D5, D6)						
Forward Voltage	I_F = 150 A, T_J = 25°C I_F = 150 A, T_J = 150°C	V_F	– –	1.97 1.79	2.51 –	V
Reverse Recovery Time	T_J = 25°C V_{CE} = 600 V, I_C = 100 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	T_{rr}	–	85	–	ns
Reverse Recovery Charge		Q_{rr}	–	5.13	–	μC
Peak Reverse Recovery Current		I_{rmm}	–	92	–	A
Reverse Peak Rate of Fall of Recovery Current		Di/dt	–	3950	–	A/μs
Reverse Recovery Energy		E_{rr}	–	1.61	–	mJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 600 V, I_C = 100 A V_{GE} = +15 V, −5 V, $R_{G(on)}$ = 15 Ω $R_{G(off)}$ = 50 Ω	T_{rr}	–	160	–	ns
Reverse Recovery Charge		Q_{rr}	–	9.84	–	μC
Peak Reverse Recovery Current		I_{rmm}	–	108	–	A
Reverse Peak Rate of Fall of Recovery Current		Di/dt	–	2250	–	A/μs
Reverse Recovery Energy		E_{rr}	–	3.64	–	mJ
Thermal Resistance – chip–to–heatsink	Thermal grease, Thickness = 2.1 Mil ±2%, λ = 2.9 W/mK	R_{thJH}	–	0.38	–	°C/W
THERMISTOR CHARACTERISTICS						
Nominal Resistance	T = 25°C	R25	–	22	–	kΩ
Nominal Resistance	T = 100°C	R100	–	1468	–	Ω
Deviation of R25		DR/R	–5	–	5	%
Power Dissipation		P_D	–	200	–	mW
Power Dissipation Constant			–	2	–	mW/°C
B–value	B(25/50), tol ±3%		–	–	3950	°C
B–value	B(25/100), tol ±3%		–	–	3998	°C
NTC Reference			–	–	B	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL STATIC CHARACTERISTICS – IGBT T1−1, T1−2, T4−1, T4−2, T2, T3 AND DIODE D1, D2, D3, D4, D5, D6

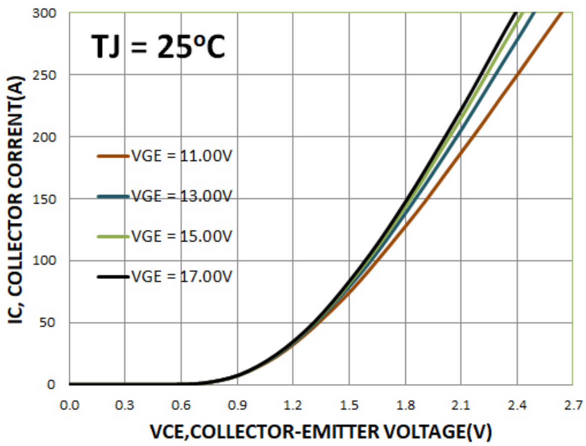


Figure 2. Typical Output Characteristics

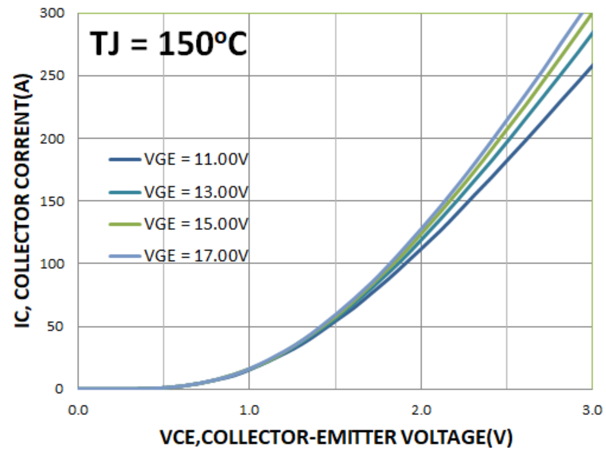


Figure 3. Typical Output Characteristics

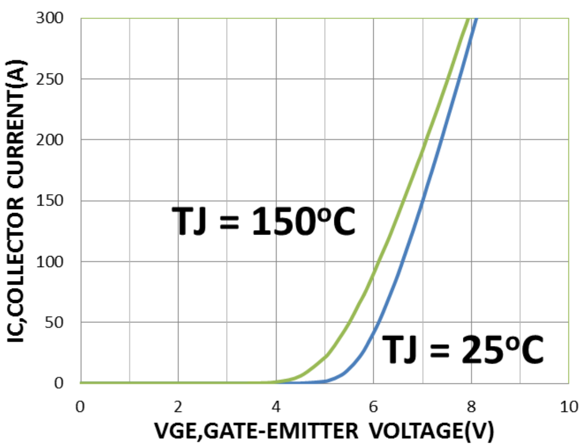


Figure 4. Typical Transfer Characteristics

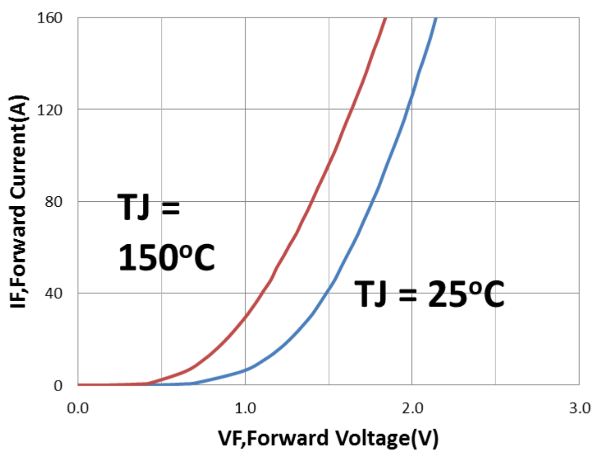


Figure 5. Diode Forward Characteristics

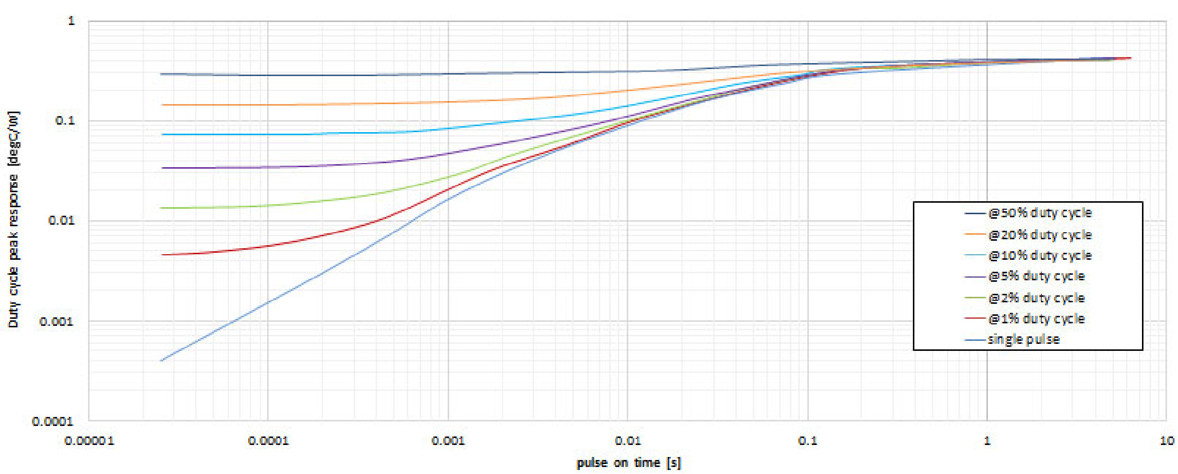


Figure 6. Transient Thermal Impedance (T1−1, T1−2, T4−1, T4−2, T2, T3)

TYPICAL STATIC CHARACTERISTICS – IGBT T1−1, T1−2, T4−1, T4−2, T2, T3 AND DIODE D1, D2, D3, D4, D5, D6 (CONTINUED)

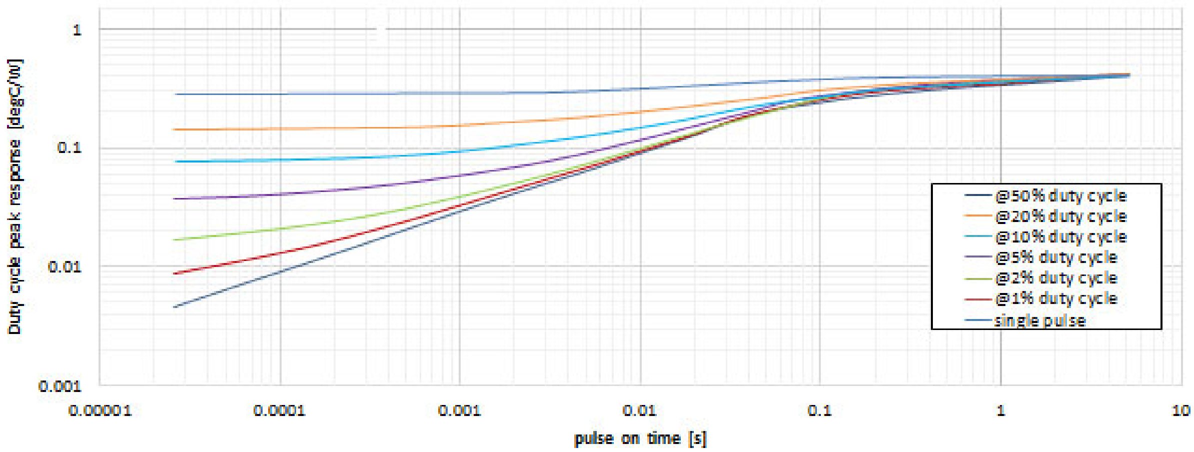


Figure 7. Transient Thermal Impedance (D1, D2, D3, D4, D5, D6)

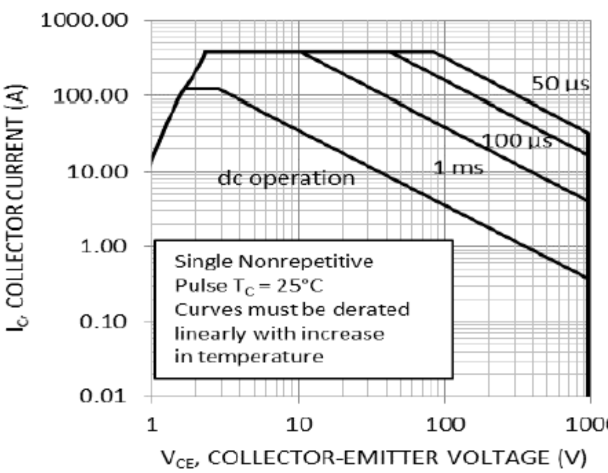


Figure 8. FBSOA (T1−1, T1−2, T4−1, T4−2, T2, T3)

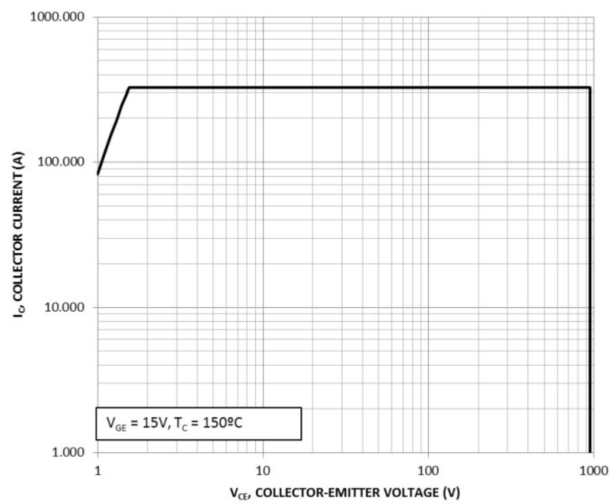


Figure 9. RBSOA (T1−1, T1−2, T4−1, T4−2, T2, T3)

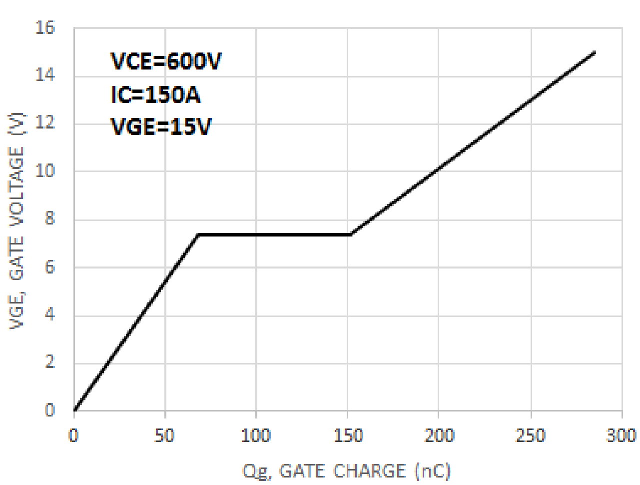


Figure 10. Gate Voltage vs. Gate Charge

TYPICAL STATIC CHARACTERISTICS – IGBT T5, T6

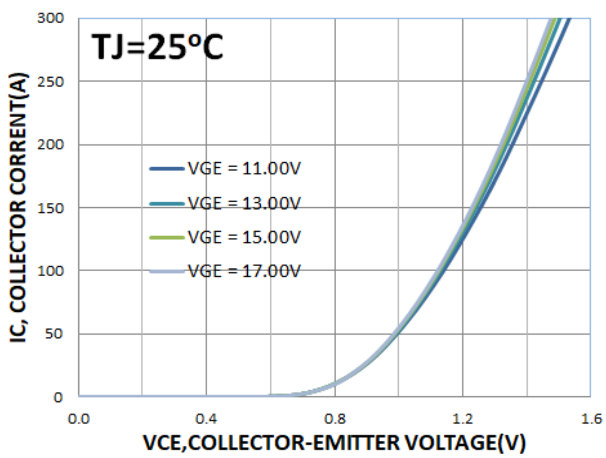


Figure 11. Typical Output Characteristics

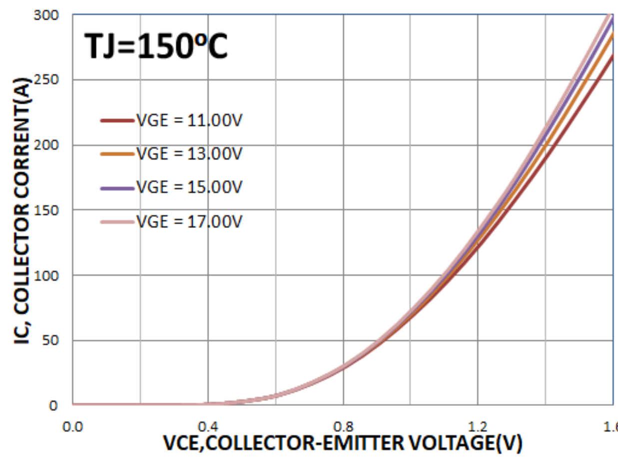


Figure 12. Typical Output Characteristics

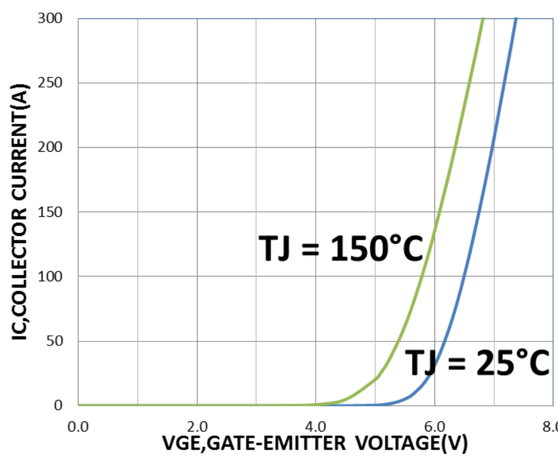


Figure 13. Typical Transfer Characteristics

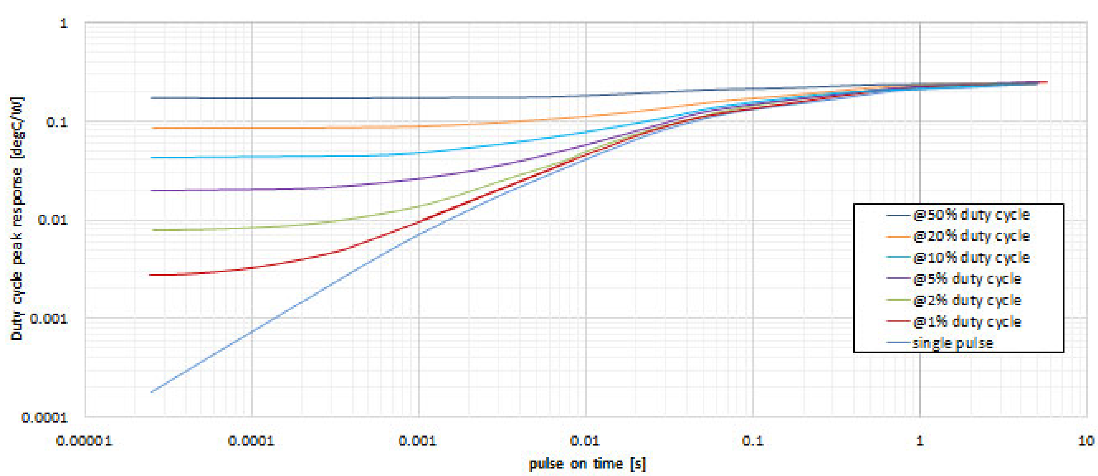


Figure 14. Transient Thermal Impedance (T5, T6)

TYPICAL STATIC CHARACTERISTICS – IGBT T5, T6 (CONTINUED)

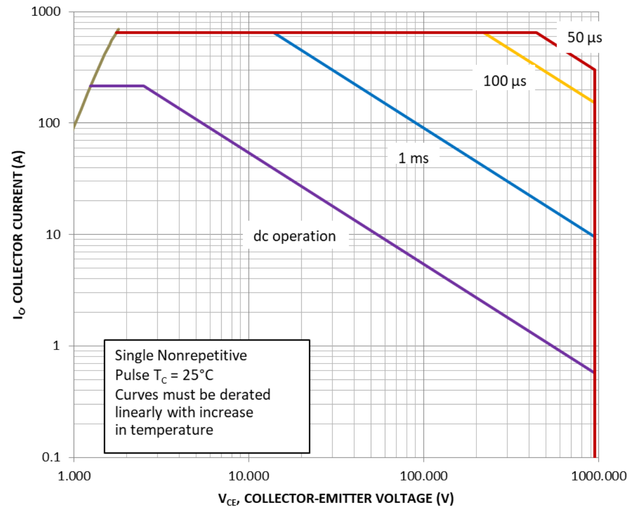


Figure 15. FBSOA (T5, T6)

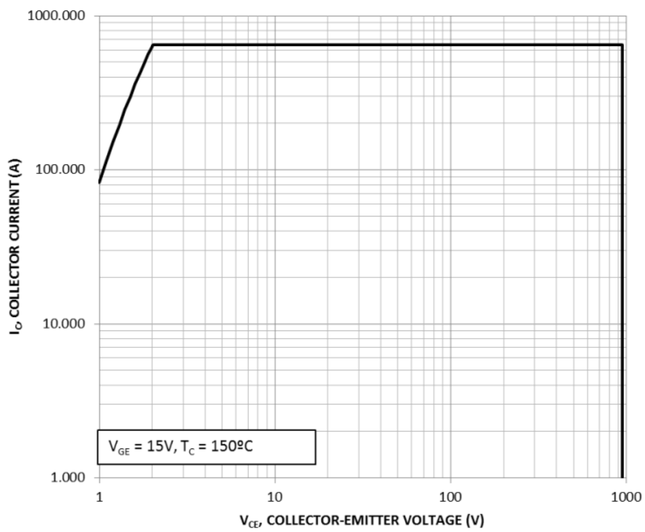


Figure 16. RBSOA (T5, T6)

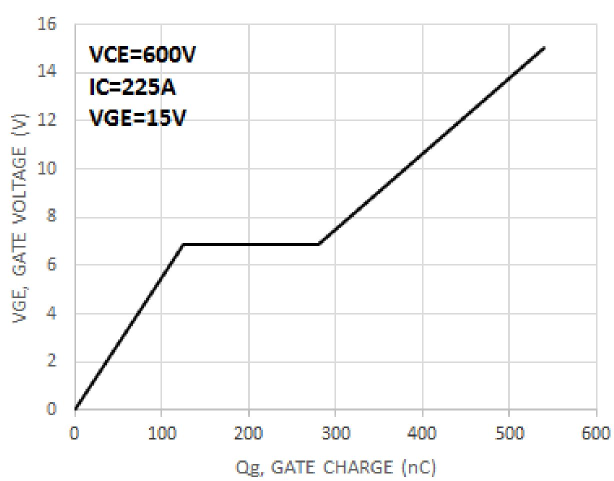


Figure 17. Gate Voltage vs. Gate Charge

TYPICAL DYNAMIC CHARACTERISTICS – T1/T4 IGBT COMUTATES D2/D3 DIODE

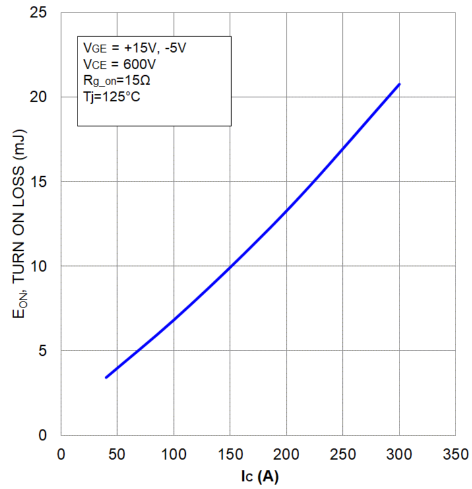


Figure 18. Typical Turn ON Loss vs. IC

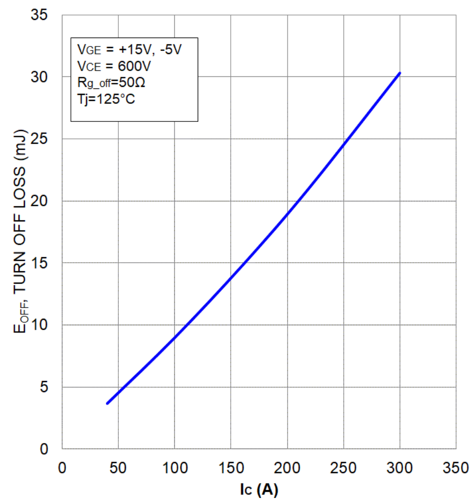


Figure 19. Typical Turn OFF Loss vs. IC

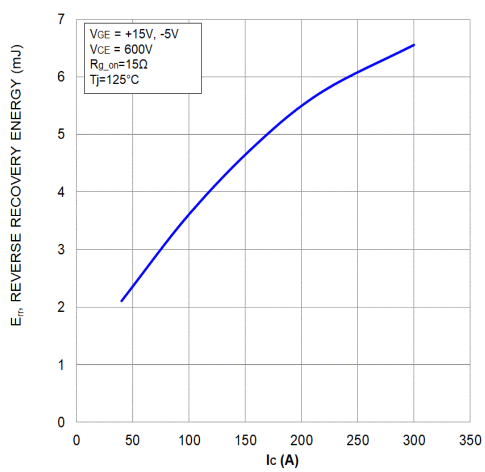


Figure 20. Typical Reverse Recovery Energy Loss vs. IC

TYPICAL DYNAMIC CHARACTERISTICS – T2/T3 IGBT COMUTATES D1/D4 DIODE

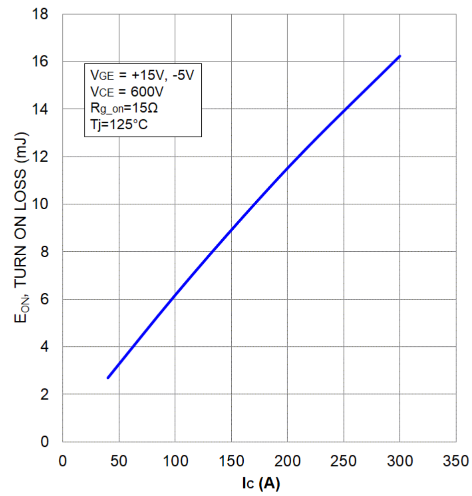


Figure 21. Typical Turn ON Loss vs. IC

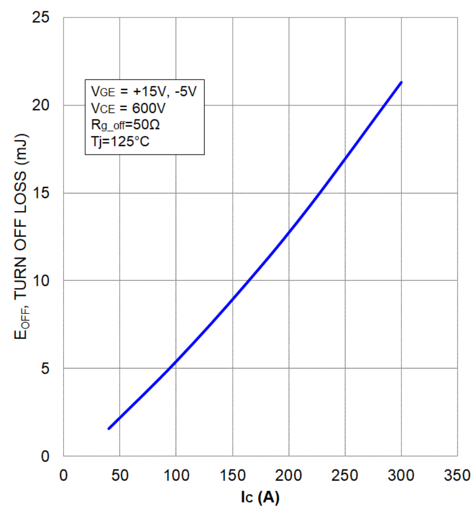


Figure 22. Typical Turn OFF Loss vs. IC

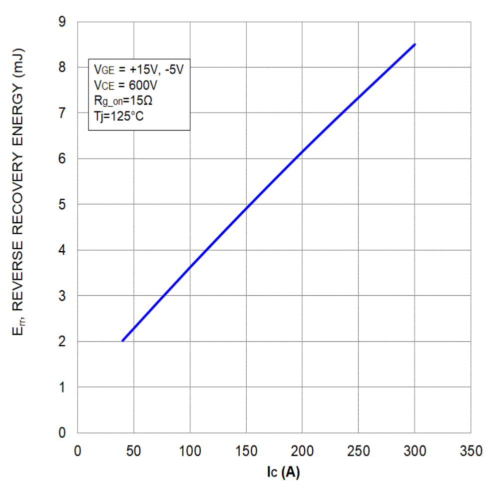


Figure 23. Typical Reverse Recovery Energy Loss vs. IC

TYPICAL DYNAMIC CHARACTERISTICS – T5/T6 IGBT COMUTATES DIODE D4−D6/D1−D5

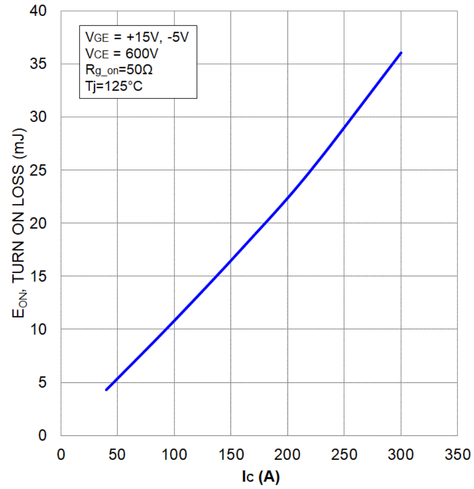


Figure 24. Typical Turn ON Loss vs. IC

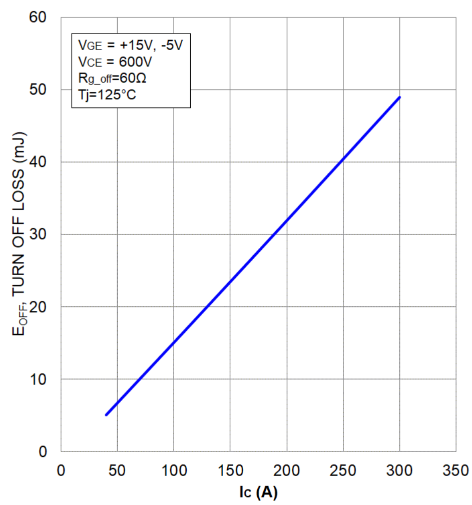


Figure 25. Typical Turn OFF Loss vs. IC

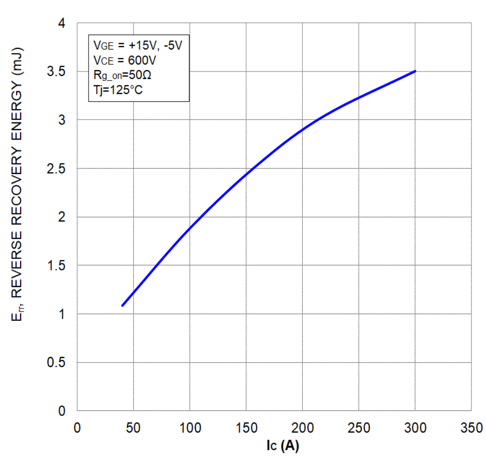
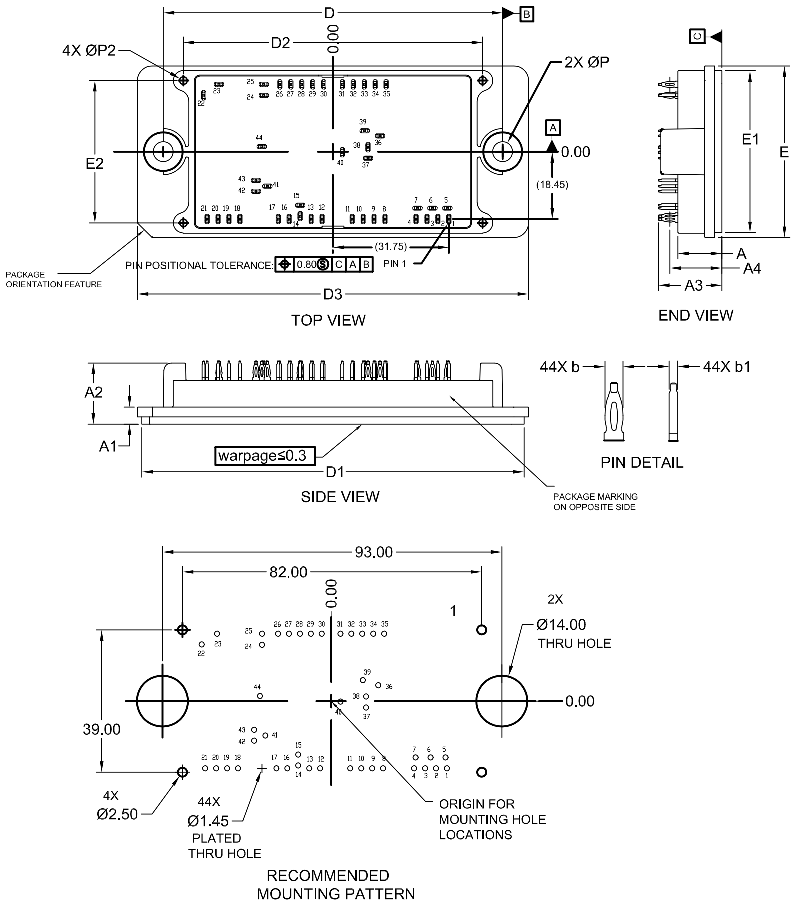


Figure 26. Typical Reverse Recovery Energy Loss vs. IC

PACKAGE DIMENSIONS

PIM44, 93.00x47.00x12.00
CASE 180AW
ISSUE C



DIM	MILLIMETERS MIN.	NOM.	MAX.
A	11.70	12.00	12.30
A1	4.40	4.70	5.00
A2	16.40	16.70	17.00
A3	16.90	17.30	17.70
A4	13.97	14.18	14.39
b	1.630	1.645	1.665
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	46.20	47.00	47.80
E1	44.10	44.40	44.70
E2	38.80	39.00	39.10
P	5.40	5.50	5.60
P1	5.05	5.35	5.65
P2	1.80	2.00	2.20

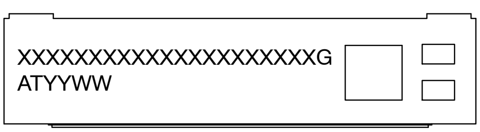
NOTE 4

PIN	PIN POSITION X	Y	PIN	PIN POSITION X	Y
1	66.25	0.00	23	3.25	36.90
2	63.25	0.00	24	15.55	33.90
3	60.25	0.00	25	15.55	36.90
4	57.25	0.00	26	19.95	36.90
5	65.85	3.00	27	22.95	36.90
6	61.75	3.00	28	25.95	36.90
7	57.65	3.00	29	28.95	36.90
8	48.75	0.00	30	31.95	36.90
9	45.75	0.00	31	37.05	36.90
10	42.75	0.00	32	40.05	36.90
11	39.75	0.00	33	43.05	36.90
12	31.50	0.00	34	46.05	36.90
13	28.50	0.00	35	49.05	36.90
14	25.50	0.80	36	47.40	22.80
15	25.50	3.80	37	44.10	16.70
16	22.50	0.00	38	44.10	19.70
17	19.50	0.00	39	43.20	24.20
18	9.00	0.00	40	37.05	18.30
19	6.00	0.00	41	16.50	9.00
20	3.00	0.00	42	13.40	7.60
21	0.00	0.00	43	13.40	10.60
22	-0.95	33.95	44	15.00	19.80

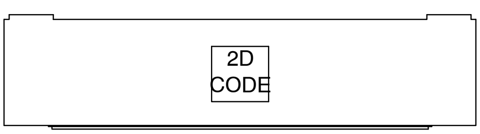
NOTES:

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 A4.
4. POSITION OF THE CENTER OF THE TERMINALS IS DETERMINED FROM DATUM B THE CENTER OF DIMENSION D, X DIRECTION, AND FROM DATUM A, Y DIRECTION. POSITIONAL TOLERANCE, AS NOTED IN DRAWING, APPLIES TO EACH TERMINAL IN BOTH DIRECTIONS.
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.
6. PRESS FIT PIN

GENERIC MARKING DIAGRAM*



FRONTSIDE MARKING



BACKSIDE MARKING

XXXXX = Specific Device Code
G = Pb−Free Device
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

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
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