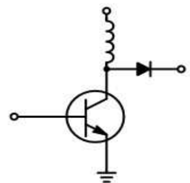
NPN Silicon Power Transistor

BUX48 BUX48A

15 AMPERES, 400 and 450 VOLTS,175 WATTS

TO-3
Metal Can Package
RoHS compliant

TO-3



FEATURES:

The BUX 48/BUX 48A transistors are designed for high–voltage, high–speed, power switching in inductive circuits where fall time is critical. They are particularly suited for line–operated circuits.

Fast Turn–Off Times
- 60 ns Inductive Fall Time - 25º C (Typ)
- 120 ns Inductive Crossover Time - 25º C (Typ)

Operating Temperature Range -65 to +200º C

100º C Performance Specified for:
- Reverse–Biased SOA with Inductive Loads
- Switching Times with Inductive Loads
- Saturation Voltage
- Leakage Currents (125º C)

APPLICATIONS:

1. Switching Regulators
2. Inverters
3. Solenoid and Relay Drivers
4. Motor Controls
5. Deflection Circuits

ABSOLUTE MAXIMUM RATINGS (T_a = 25 ºC)

Rating	Symbol	BUX48	BUX48A	Unit
Collector–Emitter Voltage	$V_{CEO(sus)}$	400	450	Vdc
Collector–Emitter Voltage (V_{BE} = – 1.5 V)	VCEX	850	1000	Vdc
Emitter Base Voltage	V_{EB}	7		Vdc
Collector Current — Continuous — Peak (1) — Overload	I_C I_{CM} I_{OI}	15 30 60		Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	5 20		Adc
Total Power Dissipation — T_C = 25°C — T_C = 100°C Derate above 25°C	P_D	175 100 1		Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	R_{JC}	1	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8 from Case for 5 Seconds	T_L	275	°C

(1) Pulse Test: Pulse Width = 5 ms, Duty Cycle ≤ 10%.

ELECTRICAL CHARACTERISTICS (T_A=25 º C unless otherwise specified)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)						
Collector–Emitter Sustaining Voltage (Table 1) (I_C = 200 mA, I_B = 0) L = 25 mH	BUX48 BUX48A	$V_{CEO(sus)}$	400 450	— —	— —	Vdc
Collector Cutoff Current (V_{CEX} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEX} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)		I_{CEX}	— —	— —	0.2 2	mAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEX}, R_{BE} = 10)	T_C = 25°C T_C = 125°C	I_{CER}	— —	— —	0.5 3	mAdc
Emitter Cutoff Current (V_{EB} = 5 Vdc, I_C = 0)		I_{EBO}	—	—	0.1	mAdc
Emitter–Base Breakdown Voltage (I_E = 50 mA – I_C = 0)		$V_{(BR)EBO}$	7	—	—	Vdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$	See Figure 12			
Clamped Inductive SOA with Base Reverse Biased		RBSOA	See Figure 13			
ON CHARACTERISTICS (1)						
DC Current Gain (I_C = 10 Adc, V_{CE} = 5 Vdc) (I_C = 8 Adc, V_{CE} = 5 Vdc)	BUX48 BUX48A	h_{FE}	8 8	— —	— —	
Collector–Emitter Saturation Voltage (I_C = 10 Adc, I_B = 2 Adc) (I_C = 15 Adc, I_B = 3 Adc) (I_C = 10 Adc, I_B = 2 Adc, T_C = 100°C) (I_C = 8 Adc, I_B = 1.6 Adc) (I_C = 12 Adc, I_B = 2.4 Adc) (I_C = 8 Adc, I_B = 1.6 Adc, T_C = 100°C)	BUX48 BUX48A	$V_{CE(sat)}$	— — — — — —	— — — — — —	1.5 5 2 1.5 5 2	Vdc
Base–Emitter Saturation Voltage (I_C = 10 Adc, I_B = 2 Adc) (I_C = 10 Adc, I_B = 2 Adc, T_C = 100°C) (I_C = 8 Adc, I_B = 1.6 Adc) (I_C = 8 Adc, I_B = 1.6 Adc, T_C = 100°C)	BUX48 BUX48A	$V_{BE(sat)}$	— — — —	— — — —	1.6 1.6 1.6 1.6	Vdc
DYNAMIC CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1 MHz)		C_{ob}	—	—	350	pF

SWITCHING CHARACTERISTICS Resistive Load (Table 1)

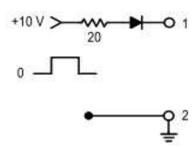
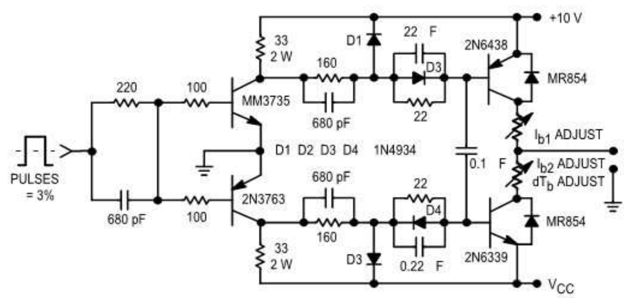
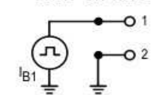
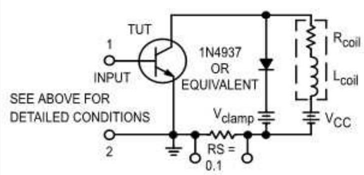
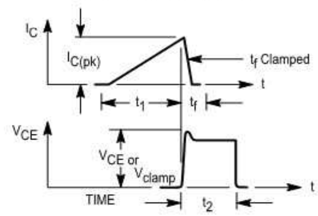
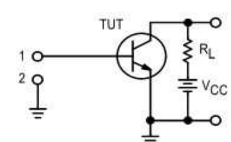
Characteristic	Conditions		Symbol	Min	Typ	Max	Unit
Delay Time	I_C = 10 A, I_B = 2 A I_C = 8 A, I_B = 1.6 A Duty Cycle = 2%, $V_{BE(off)}$ = 5 V T_p = 30 s, V_{CC} = 300 V	BUX48 BUX48A	t_d	—	0.1	0.2	s
Rise Time			t_r	—	0.4	0.7	
Storage Time			t_s	—	1.3	2	
Fall Time			t_f	—	0.2	0.4	

Inductive Load, Clamped (Table 1)

Characteristic	Conditions			Symbol	Min	Typ	Max	Unit
Storage Time	I_C = 10 A I_{B1} = 2 A	BUX48	(T_C = 25°C)	t_{sv}	—	1.3	—	s
Fall Time				t_{fi}	—	0.06	—	
Storage Time	I_C = 8 A I_{B1} = 1.6 A	BUX48A	(T_C = 100°C)	t_{sv}	—	1.5	2.5	
Crossover Time				t_c	—	0.3	0.6	
Fall Time				t_{fi}	—	0.17	0.35	

(1) Pulse Test: Pulse Width = 300 s, Duty Cycle ≤ 2%.
Vcl = 300 V, $V_{BE(off)}$ = 5 V, Lc = 180 H

Table 1. Test Conditions for Dynamic Performance

	$V_{CEO(sus)}$	RBSOA AND INDUCTIVE SWITCHING	RESISTIVE SWITCHING
INPUT CONDITIONS	 PW Varied to Attain I_C = 200 mA		TURN–ON TIME  I_{B1} adjusted to obtain the forced h_{FE} desired. TURN–OFF TIME: Use inductive switching driver as the input to the resistive test circuit.
CIRCUIT VALUES	L_{coil} = 25 mH, V_{CC} = 10 V R_{coil} = 0.7	L_{coil} = 180 H R_{coil} = 0.05 V_{CC} = 20 V V_{clamp} = 300 V R_B ADJUSTED TO ATTAIN DESIRED I_{B1}	V_{CC} = 300 V R_L = 83 Pulse Width = 10 s
TEST CIRCUITS	INDUCTIVE TEST CIRCUIT 	OUTPUT WAVEFORMS  t_1 Adjusted to Obtain I_C $t_1 \approx \frac{L_{coil}(I_{Cpk})}{V_{CC}}$ $t_2 \approx \frac{L_{coil}(I_{Cpk})}{V_{Clamp}}$ Test Equipment Scope — Tektronix 475 or Equivalent	RESISTIVE TEST CIRCUIT 

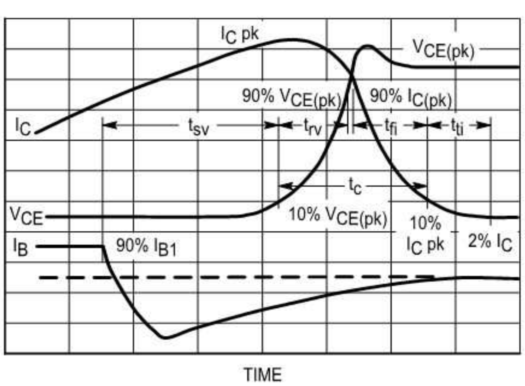


Figure 7. Inductive Switching Measurements

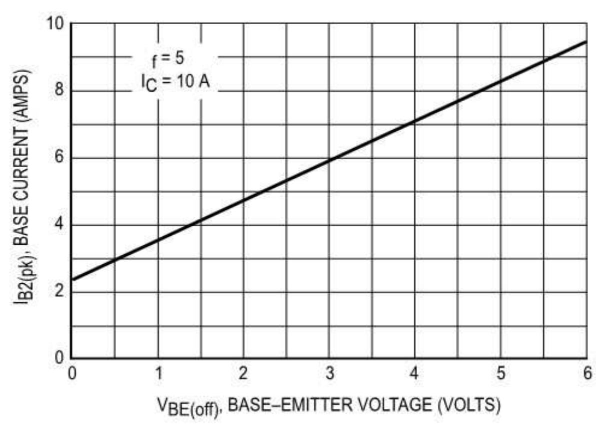


Figure 8. Peak–Reverse Current

INDUCTIVE SWITCHING

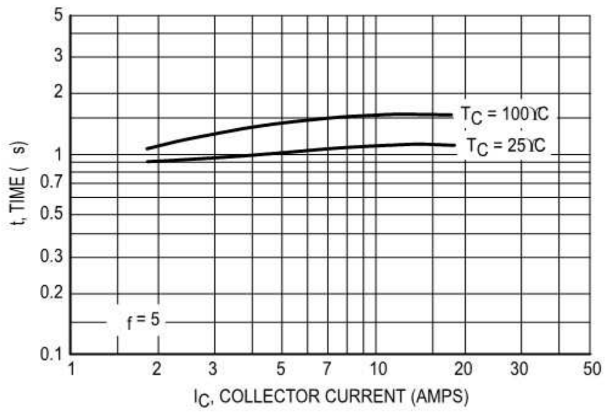


Figure 9. Storage Time, t_{sv}

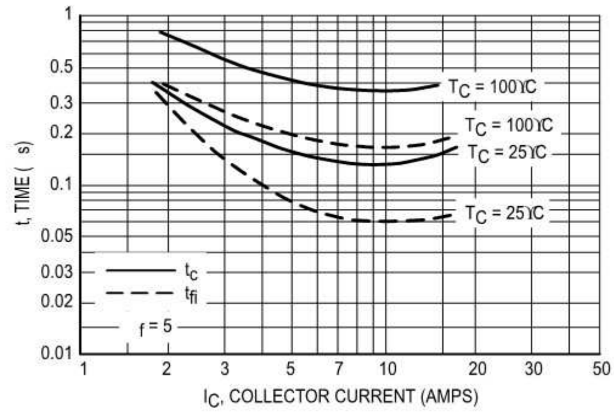


Figure 10. Crossover and Fall Times

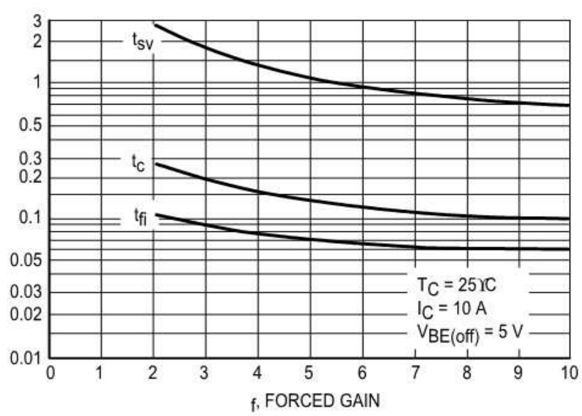


Figure 11a. Turn–Off Times versus Forced Gain

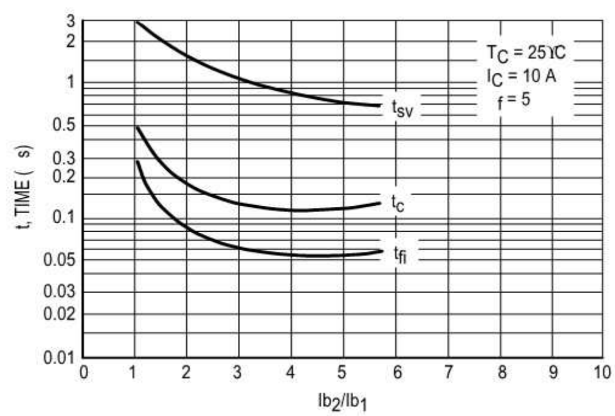


Figure 11b. Turn–Off Times versus Ib_2/Ib_1

Typical Characteristic Curves

The Safe Operating Area figures shown in Figures 12 and 13 are specified for these devices under the test conditions shown.

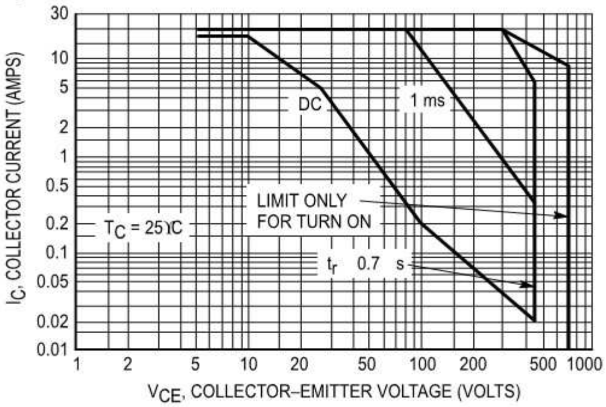


Figure 12. Forward Bias Safe Operating Area

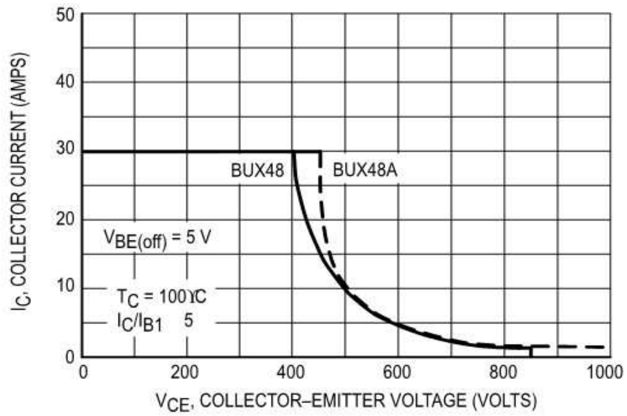


Figure 13. Reverse Bias Safe Operating Area

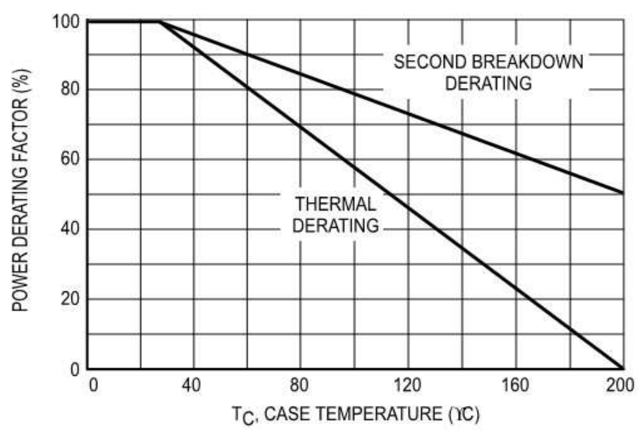


Figure 14. Power Derating

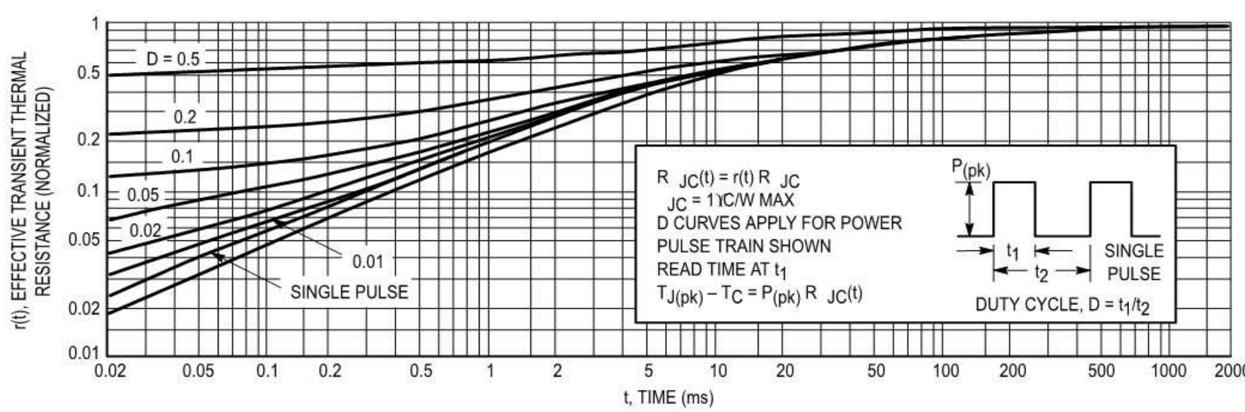


Figure 15. Thermal Response

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Rev0_02052020EM

Typical Characteristic Curves

OVERLOAD CHARACTERISTICS

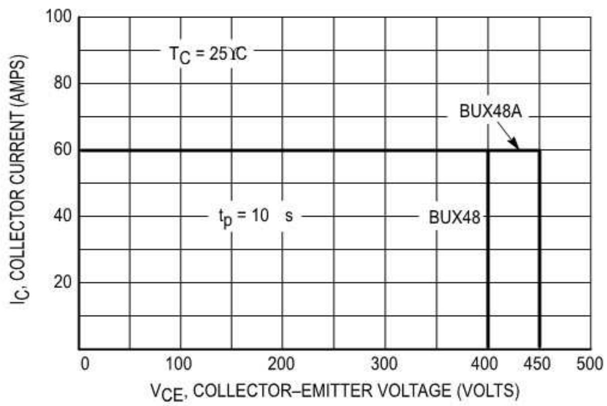

Figure 16. Rated Overload Safe Operating Area (OLSOA)

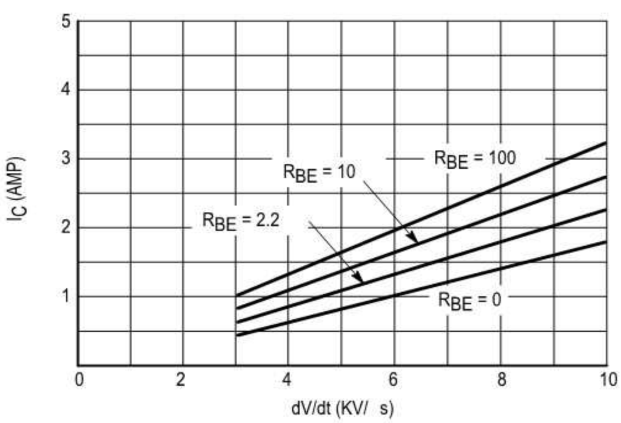

Figure 17. I_C = f(dV/dt)

Notes:
- $V_{CE} = V_{CC} + V_{BE}$
- Adjust pulsed current source for desired I_C, t_p

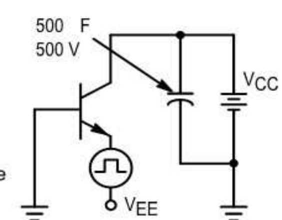

Figure 18. Overload SOA Test Circuit

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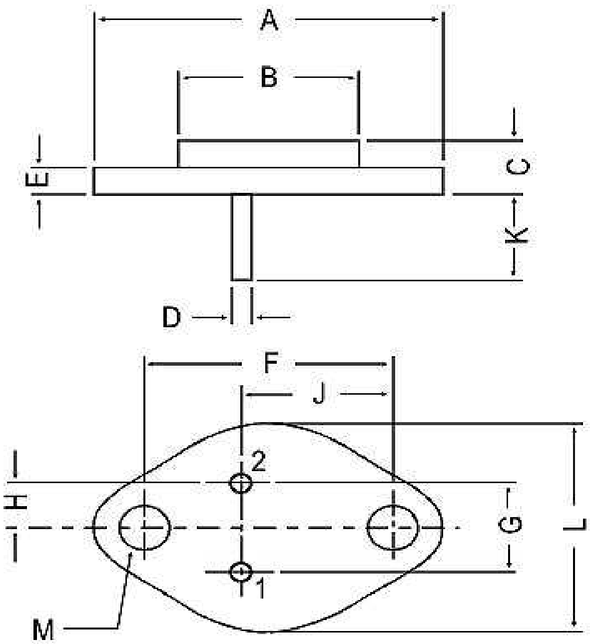
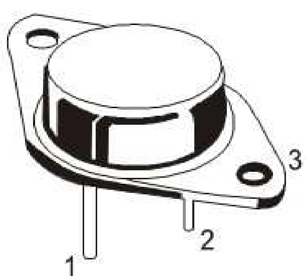
Package Details



All dimensions in mm.

DIM	MIN.	MAX.
A	—	39.37
B	—	22.22
C	6.35	8.50
D	0.96	1.09
E	—	1.77
F	29.90	30.40
G	10.69	11.18
H	5.20	5.72
J	16.64	17.15
K	11.15	12.25
L	—	26.67
M	3.84	4.19



PIN CONFIGURATION
1. BASE
2. EMITTER
3. COLLECTOR

Packing Detail

PACKAGE	STANDARD PACK		INNER CARTON BOX		OUTER CARTON BOX		
	Details	Net Weight/Qty	Size	Qty	Size	Qty	Gr Wt
TO-3	100 pcs/pkt	1.3 kg/100 pcs	12.5" x 8" x 1.8"	0.1K	17" x 11.5" x 21"	2K	27.5 kgs

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Recommended Product Storage Environment for Discrete Semiconductor Devices

This storage environment assumes that the Diodes and transistors are packed properly inside the original packing supplied by CDIL.

- Temperature 5 °C to 30 °C
- Humidity between 40 to 70 %RH
- Air should be clean.
- Avoid harmful gas or dust.
- Avoid outdoor exposure or storage in areas subject to rain or water spraying .
- Avoid storage in areas subject to corrosive gas or dust. Product shall not be stored in areas exposed to direct sunlight.
- Avoid rapid change of temperature.
- Avoid condensation.
- Mechanical stress such as vibration and impact shall be avoided.
- The product shall not be placed directly on the floor.
- The product shall be stored on a plane area. They should not be turned upside down. They should not be placed against the wall.

Shelf Life of CDIL Products

The shelf life of products is the period from product manufacture to shipment to customers. The product can be unconditionally shipped within this period. The period is defined as 2 years.
If products are stored longer than the shelf life of 2 years the products shall be subjected to quality check as per CDIL quality procedure.
The products are further warranted for another one year after the date of shipment subject to the above conditions in CDIL original packing.

Floor Life of CDIL Products and MSL Level

When the products are opened from the original packing, the floor life will start.

For this, the following JEDEC table may be referred:

JEDEC MSL Level		
Level	**Time**	**Condition**
1	Unlimited	≤30 °C / 85% RH
2	1 Year	≤30 °C / 60% RH
2a	4 Weeks	≤30 °C / 60% RH
3	168 Hours	≤30 °C / 60% RH
4	72 Hours	≤30 °C / 60% RH
5	48 Hours	≤30 °C / 60% RH
5a	24 Hours	≤30 °C / 60% RH
6	Time on Label(TOL)	≤30 °C / 60% RH

Customer Notes

Component Disposal Instructions

1. CDIL Semiconductor Devices are RoHS compliant, customers are requested to please dispose as per prevailing Environmental Legislation of their Country.
2. In Europe, please dispose as per EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).

Disclaimer

The product information and the selection guides facilitate selection of the CDIL's Semiconductor Device(s) best suited for application in your product(s) as per your requirement. It is recommended that you completely review our Data Sheet(s) so as to confirm that the Device(s) meet functionality parameters for your application. The information furnished in the Data Sheet and on the CDIL Web Site/CD are believed to be accurate and reliable. CDIL however, does not assume responsibility for inaccuracies or incomplete information. Furthermore, CDIL does not assume liability whatsoever, arising out of the application or use of any CDIL product; neither does it convey any license under its patent rights nor rights of others. These products are not designed for use in life saving/support appliances or systems. CDIL customers selling these products (either as individual Semiconductor Devices or incorporated in their end products), in any life saving/support appliances or systems or applications do so at their own risk and CDIL will not be responsible for any damages resulting from such sale(s).
CDIL strives for continuous improvement and reserves the right to change the specifications of its products without prior notice.

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