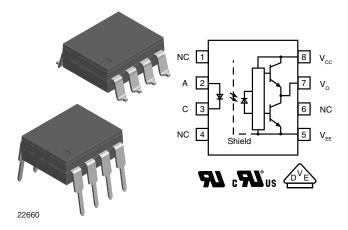
VOW3120

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Widebody 2.5 A IGBT and MOSFET Driver



DESCRIPTION

The VOW3120 consists of an infrared light emitting diode optically coupled to an integrated circuit with a power output stage. This optocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control and inverter applications. The high operating voltage range of the output stage provides the drive voltages required by gate controlled devices. The voltage and current supplied by this optocoupler makes it ideally suited for directly driving IGBTs with ratings up to 1200 V/100 A. For IGBTs with higher ratings, the VOW3120 can be used to drive a discrete power stage which drives the IGBT gate.

The VOW3120 provides higher isolation for applications operating at higher working voltages, and or higher pollution degree criteria. Higher V_{IORM} , V_{IOTM} , creepage and clearance distances, make the VOW3120 ideal for many industrial control and power conversion applications.

FEATURES

- 2.5 A minimum peak output current
- 10 mm minimum external creepage distance
- 50 kV/µs (typ.) common mode rejection
- I_{CC} = 2.5 mA maximum supply current
- Under voltage lock-out (UVLO) with hysteresis
- Wide operating V_{CC} range: 15 V to 32 V
- Industrial temperature range: -40 °C to +100 °C
- Material categorization: for definitions of compliance please see <u>www.vishay.com/doc?99912</u>

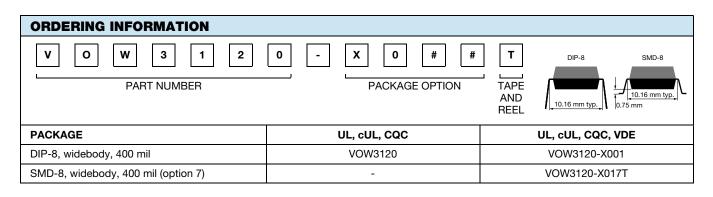
APPLICATIONS

- Industrial welding equipment
- Motor drives
- Industrial inverters
- Commercial and residential solar inverters
- · Wind generator inverters
- EV and plug-in HEV chargers

AGENCY APPROVALS

All parts are certified under base model VOW3120. This model number should be used when consulting safety agency documents.

- UL1577
- cUL
- CQC
- DIN EN 60747-5-5 (VDE 0884-5)



1

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(e3)

RoHS COMPLIANT HALOGEN FREE <u>GREEN</u> (5-2008)



ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT			
INPUT							
Input forward current		I _F	25	mA			
Peak transient input current	< 1 µs pulse width, 300 pps	I _{F(TRAN)}	1	А			
Reverse input voltage		V _R	5	V			
Input power dissipation		P _{diss}	40	mW			
LED junction temperature		Тj	125	°C			
OUTPUT							
High peak output current ⁽¹⁾		I _{OH(PEAK)}	2.5	А			
Low peak output current ⁽¹⁾		I _{OL(PEAK)}	2.5	A			
Supply voltage		(V _{CC} - V _{EE})	0 to +35	V			
Output voltage		V _{O(PEAK)}	0 to +V _{CC}	V			
Output power dissipation		P _{diss}	220	mW			
Output junction temperature		Tj	125	°C			
OPTOCOUPLER	OPTOCOUPLER						
Storage temperature range		T _{stg}	-55 to +150	°C			
Ambient operating temperature range		T _{amb}	-40 to +100	°C			
Total power dissipation		P _{tot}	260	mW			
Lead solder temperature	For 10 s, 1.6 mm below seating plane	T _{sld}	260	°C			

Notes

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not
implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute
maximum ratings for extended periods of the time can adversely affect reliability.

⁽¹⁾ Maximum pulse width = 10 μ s, maximum duty cycle = 0.2 %. This value is intended to allow for component tolerances for designs with I_O peak minimum = 2.5 A. See applications section for additional details on limiting I_{OH} peak.

RECOMMENDED OPERATING CONDITION							
PARAMETER	SYMBOL	MIN.	MAX.	UNIT			
Power supply voltage	V _{CC} - V _{EE}	15	32	V			
Input LED current (on)	١ _F	10	-	mA			
Input voltage (off)	V _{F(OFF)}	-3	0.8	V			
Operating temperature	T _{amb}	-40	+100	°C			

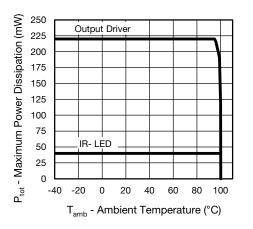


Fig. 1 - Dissipated Operating Power vs. Operating Temperature

VOW3120



THERMAL CHARACTERISTICS

THERMAL CHARACTERISTICS				
PARAMETER	SYMBOL	VALUE	UNIT	θερ
LED power dissipation	P _{LED}	40	mW	
Output power dissipation	P _{OUT}	220	mW	
Total power dissipation	P _{TOT}	260	mW	
Maximum LED junction temperature	T _{j max.}	125	°C	T _{JB}
Maximum output die junction temperature	T _{j max.}	125	°C	J. L
Thermal resistance, LED to output	θ_{ED}	315	°C/W	
Thermal resistance, LED to board	θ_{EB}	300	°C/W	
Thermal resistance, output to board	θ_{DB}	80	°C/W	
Thermal resistance, board to ambient	θ_{BA}	50	°C/W	- ∮T _{amb}

Note

The thermal characteristics table above were measured at 25 °C and the thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's Thermal Characteristics of Optocouplers application note.

ELECTRICAL CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
	$V_{\rm O} = (V_{\rm CC} - 4 \text{ V})$	I _{OH}	0.5	-	-	А
High level output current	V _O = (V _{CC} - 15 V)	I _{OH}	2.5	-	-	А
	$V_{O} = (V_{EE} + 2.5 V)$	I _{OL}	0.5	-	-	А
Low level output current	V _O = (V _{EE} + 15 V)	I _{OL}	2.5	-	-	А
High level output voltage	I _O = -100 mA	V _{OH}	V _{CC} - 4	-	-	V
Low level output voltage	I _O = 100 mA	V _{OL}	-	0.2	0.5	V
High level supply current	Output open, $I_F = 10 \text{ mA}$ to 16 mA	I _{CCH}	-	-	2.5	mA
Low level supply current	Output open, $V_F = -3 V$ to +0.8 V	I _{CCL}	-	-	2.5	mA
Threshold input current low to high	$I_{O} = 0 \text{ mA}, V_{O} > 5 \text{ V}$	I _{FLH}	-	3.4	8	mA
Threshold input voltage high to low		V _{FHL}	0.8	-	-	V
Input forward voltage	I _F = 10 mA	V _F	1	1.36	1.6	V
Temperature coefficient of forward voltage	I _F = 10 mA	$\Delta V_F / \Delta T_{amb}$	-	-1.4	-	mV/°C
Input reverse breakdown voltage	I _R = 10 μA	V _(BR)	5	-	-	V
Input capacitance	$f = 1 \text{ MHz}, V_F = 0 \text{ V}$	C _{IN}	-	45	-	pF
		V _{UVLO +}	11	-	13.5	V
UVLO threshold	$V_O \ge 5 V$, $I_F = 10 mA$	V _{UVLO -}	9.5	-	12	V
UVLO hysteresis		UVLO _{HYS}	-	1.6	-	V
Capacitance (input to output)	$f = 1 MHz, V_F = 0 V$	C _{IO}	-	0.9	-	pF

Note

• Minimum and maximum values were tested over recommended operating conditions ($T_{amb} = -40$ °C to +100 °C, $I_{F(ON)} = 10$ mA to 16 mA, $V_{F(OFF)} = -3$ V to 0.8 V, $V_{CC} = 15$ V to 32 V, $V_{EE} =$ ground) unless otherwise specified. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements. All typical values were measured at $T_{amb} = 25$ °C and with $V_{CC} - V_{EE} = 32$ V.



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SWITCHING	CHARACTERISTICS
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SWITCHING CHARACTERISTICS							
PARAMETER	PARAMETER TEST CONDITION S		MIN.	TYP.	MAX.	UNIT	
Propagation delay time to logic low output	R_g = 10 Ω,C_g = 10 nF, f = 10 kHz, duty cycle = 50 $\%$	t _{PHL}	0.1	0.25	0.5	μs	
Propagation delay time to logic high output	$R_g = 10 \Omega$, $C_g = 10 nF$, f = 10 kHz, duty cycle = 50 %	t _{PLH}	0.1	0.25	0.5	μs	
Pulse width distortion	$R_g = 10 \Omega$, $C_g = 10 nF$, f = 10 kHz, duty cycle = 50 %	PWD	-	-	0.3	μs	
Rise time	$R_g = 10 \Omega$, $C_g = 10 nF$, f = 10 kHz, duty cycle = 50 %	tr	-	0.1	-	μs	
Fall time	$R_g = 10 \Omega$, $C_g = 10 nF$, f = 10 kHz, duty cycle = 50 %	t _f	-	0.1	-	μs	
UVLO turn on delay	$V_{O} > 5 V, I_{F} = 10 mA$	T _{UVLO-ON}	-	0.8	-	μs	
UVLO turn off delay	$V_{O} < 5 V$, $I_{F} = 10 mA$	T _{UVLO-OFF}	-	0.6	-	μs	

Note

Minimum and maximum values were tested over recommended operating conditions ($T_{amb} = -40$ °C to +100 °C, $I_{F(ON)} = 10$ mA to 16 mA, $V_{F(OFF)} = -3$ V to 0.8 V, $V_{CC} = 15$ V to 32 V, $V_{EE} =$ ground) unless otherwise specified. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements. All typical values were measured at $T_{amb} = 25$ °C and with $V_{CC} - V_{EE} = 32$ V.

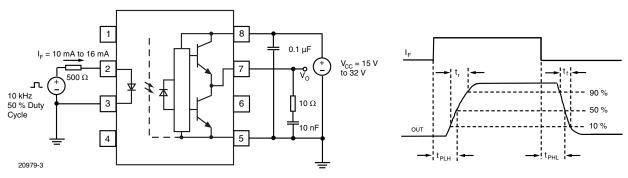


Fig. 2 - $t_{\text{PLH}},\,t_{\text{PHL}},\,t_{r}$ and t_{f} Test Circuit and Waveforms

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity at logic high output	$T_{amb} = 25 \text{ °C}, I_F = 10 \text{ mA to } 16 \text{ mA}, V_{CM} = 1500 \text{ V}, V_{CC} = 32 \text{ V}$	CM _H	25	50	-	kV/µs
Common mode transient immunity at logic low output	$T_{amb} = 25 \text{ °C}, V_{CM} = 1500 \text{ V}, V_{CC} = 32 \text{ V}, V_F = 0 \text{ V}$	CM _L	25	45	-	kV/µs

Note

• Minimum and maximum values were tested over recommended operating conditions ($T_{amb} = -40$ °C to +100 °C, $I_{F(ON)} = 10$ mA to 16 mA, $V_{F(OFF)} = -3$ V to 0.8 V, $V_{CC} = 15$ V to 32 V, $V_{EE} =$ ground) unless otherwise specified. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements. All typical values were measured at $T_{amb} = 25$ °C and with $V_{CC} - V_{EE} = 32$ V.

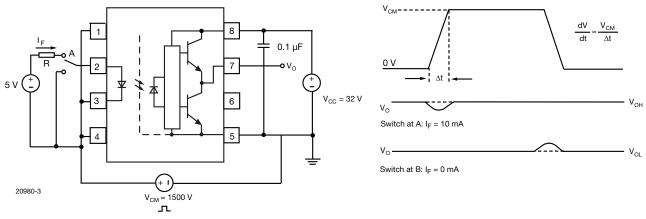


Fig. 3 - CMR Test Circuit and Waveforms

Rev. 1.2, 26-Sep-16

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VOW3120



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PARAMETER	RAMETER TEST CONDITION		VALUE	UNIT
Climatic classification	According to IEC 68 part 1		40 / 100 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group Illa	CTI	250	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V _{ISO}	5300	V _{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V _{IOTM}	8000	V _{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	VIORM	1414	V _{peak}
Isolation resistance	$T_{amb} = 25 \ ^{\circ}C, \ V_{IO} = 500 \ V$	R _{IO}	≥ 10 ¹²	Ω
Isolation resistance	$T_{amb} = 100 \ ^{\circ}C, \ V_{IO} = 500 \ V$	R _{IO}	≥ 10 ¹¹	Ω
Output safety power		P _{SO}	800	mW
Input safety current		I _{SI}	350	mA
Input safety temperature		Τ _S	175	°C
Creepage distance			≥ 10	mm
Clearance distance	DIP-8, widebody, 400 mil		≥ 10	mm
Creepage distance	CMD 9 widebody (00 mil (antion 7)		≥ 10	mm
Clearance distance	SMD-8, widebody, 400 mil (option 7)		≥ 10	mm
Insulation thickness		DTI	≥ 0.4	mm
Input to output test voltage, method B	$V_{IORM} x 1.875 = V_{PR}$, 100 % production test with $t_M = 1$ s, partial discharge < 5 pC	V _{PR}	2651	V _{peak}
Input to output test voltage, method A	$V_{IORM} x 1.6 = V_{PR}$, 100 % sample test with $t_M = 10$ s, partial discharge < 5 pC	V _{PR}	2262	V _{peak}

Note

 According to DIN EN60747-5-5 (see figure 4). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

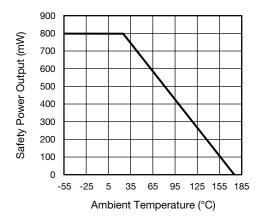


Fig. 4 - Safety Power Dissipation vs. Ambient Temperature

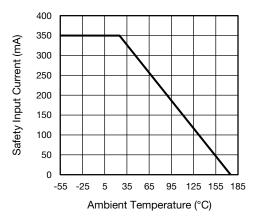


Fig. 5 - Safety Input Current vs. Ambient Temperature



TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

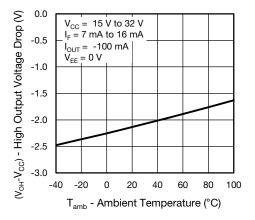


Fig. 6 - High Output Voltage Drop vs. Ambient Temperature

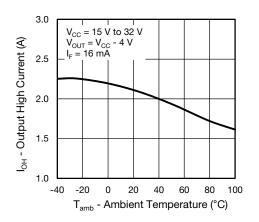


Fig. 7 - Output High Current vs. Ambient Temperature

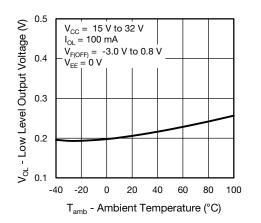


Fig. 8 - Low Level Output Voltage vs. Ambient Temperature

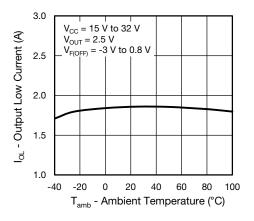


Fig. 9 - Output Low Current vs. Ambient Temperature

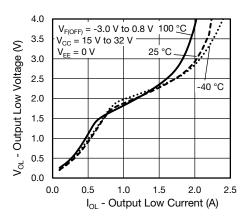


Fig. 10 - Output Low Voltage vs. Output Low Current

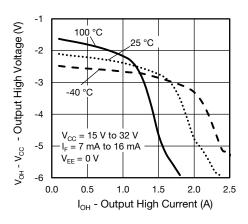
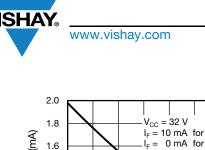


Fig. 11 - Output High Voltage vs. Output High Current



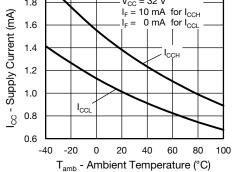


Fig. 12 - Supply Current vs. Ambient Temperature

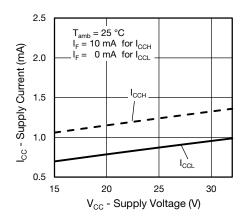


Fig. 13 - Supply Current vs. Supply Voltage

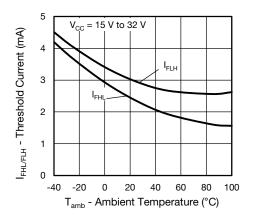


Fig. 14 - threshold Current vs. Ambient Temperature

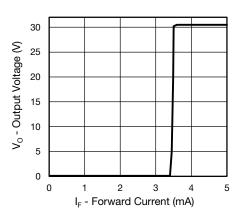


Fig. 15 - Output Voltage vs. Forward Current

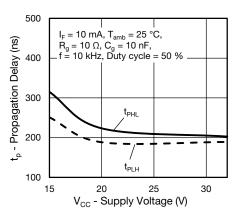


Fig. 16 - Propagation Delay vs. Supply Voltage

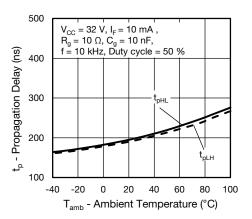
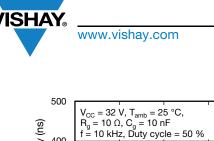


Fig. 17 - Propagation Delay vs. Ambient Temperature

Rev. 1.2, 26-Sep-16

7



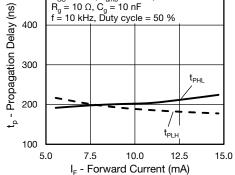


Fig. 18 - Propagation Delay vs. Forward Current

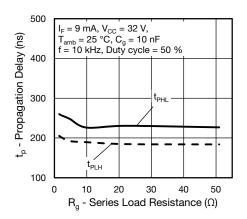


Fig. 19 - Propagation Delay vs. Series Load Resistance

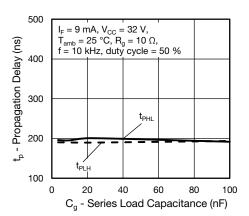


Fig. 20 - Propagation Delay vs. Series Load Capacitance

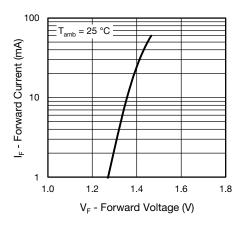
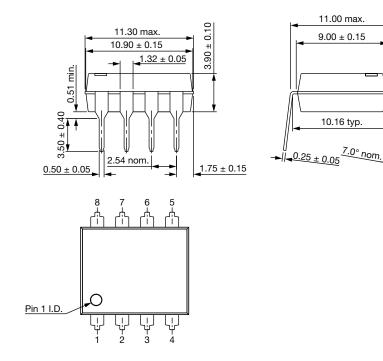


Fig. 21 - Forward Current vs. Forward Voltage

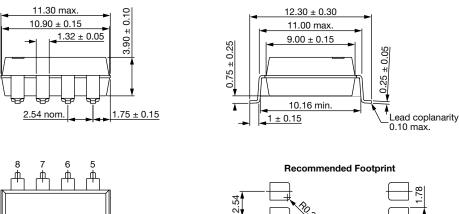
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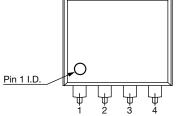
PACKAGE DIMENSIONS (in millimeters)

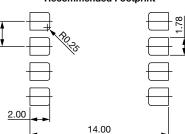
DIP-8, Widebody, 400 mil



SMD-8, Widebody, 400 mil (option 7)







9



PACKAGE MARKING

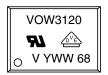


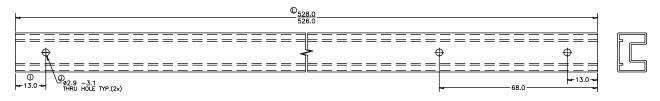
Fig. 22 - Example of VOW3120-X017T

Notes

- The VDE logo is only marked on option 1 parts.
- Tape and reel (T) and package option (option 7) is not part of the package markings.

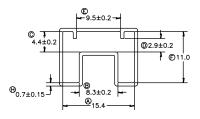
PACKING INFORMATION (in millimeters)

Tubes



DEVICE PER TUBE			
ТҮРЕ	UNITS/TUBE	TUBE/BOX	UNITS/BOX
DIP-8, widebody, 400 mil	40	30	1200

DIP-8, Widebody, 400 mil



1.	ALL TUBE TOLERANCES T UNLESS OTHERWISE SPEC	0 BE ±0.25
	UNLESS OTHERWISE SPEC	SIFIED.
2.	ALL RADII AND ANGLES F	REFERENCE
	ONLY, UNLESS OTHERWIS	E SPECIFIED.

Fig. 23 - Tape and Reel Shipping Medium

Tape and Reel

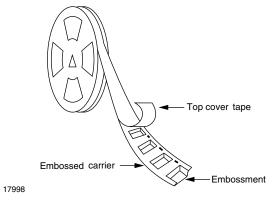


Fig. 24 - Tape and Reel Shipping Medium

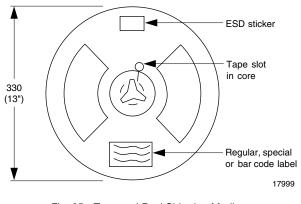


Fig. 25 - Tape and Reel Shipping Medium

10

Document Number: 82442





SMD-8, Widebody, 400 mil (option 7)

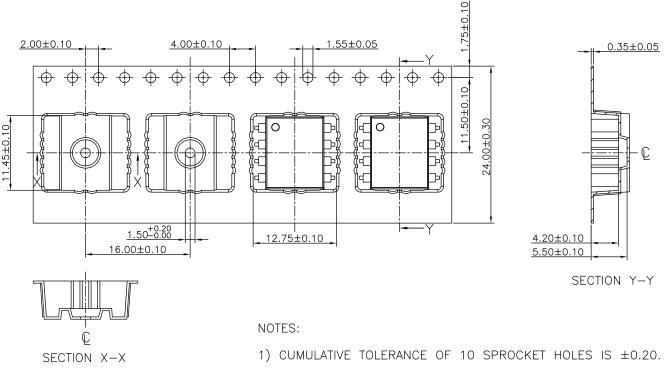


Fig. 26 - Tape and Reel Packing (750 parts per reel)

SOLDER PROFILES

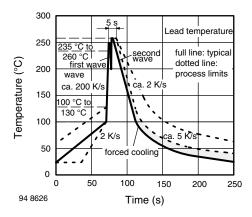


Fig. 27 - Wave Soldering Double Wave Profile According to \$J\$-STD\$-020 for DIP Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2 Floor life: unlimited Conditions: $T_{amb} < 30\ ^\circ\text{C},\ \text{RH} < 85\ \%$

Moisture sensitivity level 1, according to J-STD-020

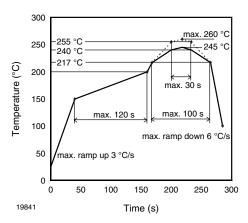


Fig. 28 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

11



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