NCV8461

Self Protected High Side Driver with Temperature Shutdown and Current Limit

The NCV8461 is a fully protected High−Side driver that can be used to switch a wide variety of loads, such as bulbs, solenoids and other activators. The device is internally protected from an overload condition by an active current limit and thermal shutdown. A diagnostic output reports OFF state open load conditions as well as thermal shutdown.

Features

- Short Circuit Protection
- Thermal Shutdown with Automatic Restart
- CMOS (3 V / 5 V) Compatible Control Input
- Off State Open Load Detection
- Open Drain Diagnostic Output
- Overvoltage Protection
- Undervoltage Shutdown
- Loss of Ground and Loss of V_D Protection
- ESD Protection
- Reverse Battery Protection (with external resistor)
- Very Low Standby Current
- AEC−Q100 Qualified

Typical Applications

- Switch a Variety of Resistive, Inductive and Capacitive Loads
- Can Replace Electromechanical Relays and Discrete Circuits
- Automotive / Industrial

FEATURE SUMMARY

Overvoltage Protection	V_{OV}	41	V
R_{DSon} (max) T_J = 25°C	R_{ON}	350	mΩ
Output Current Limit (typ)	I_{lim}	1.2	A
Operating Voltage Range	V_{OP}	5 – 34	V

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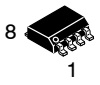
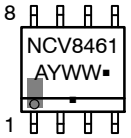


SOIC−8
CASE 751
STYLE 11

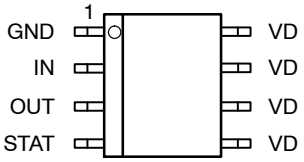
MARKING DIAGRAM



NCV8461 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(*Note: Microdot may be in either location)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NCV8461DR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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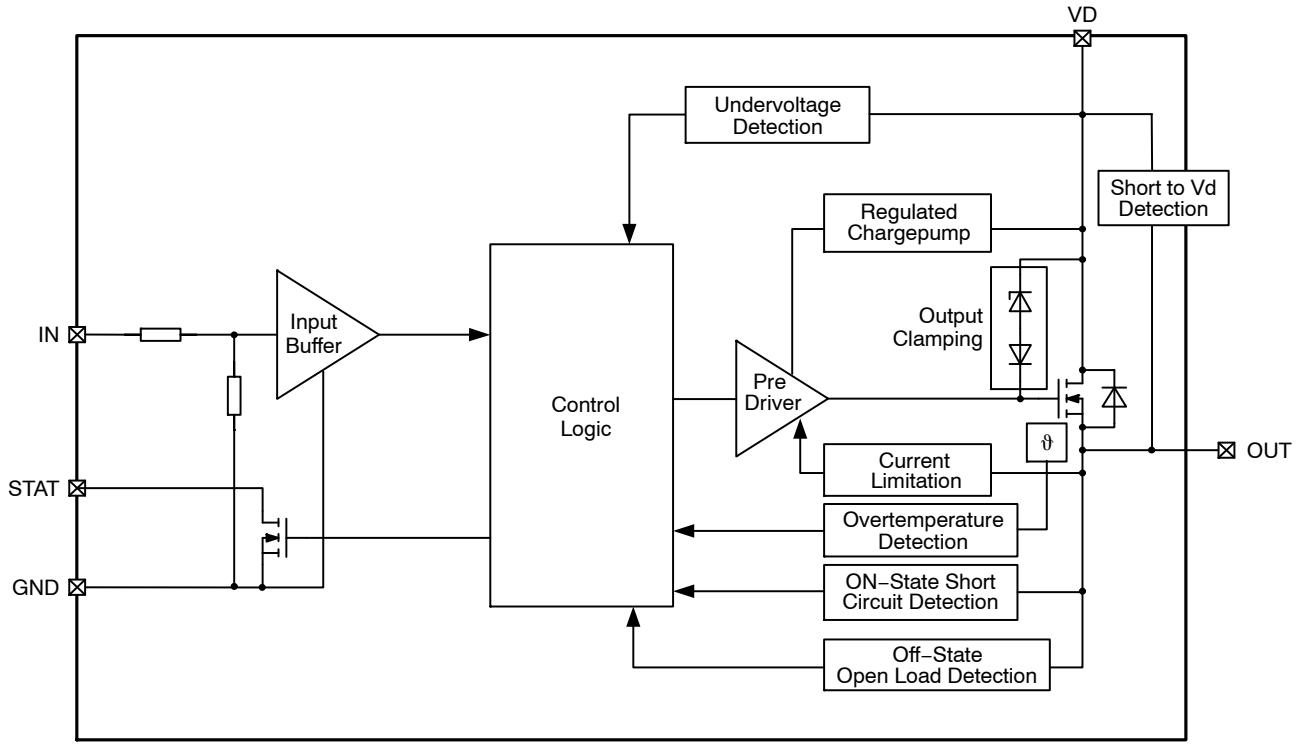


Figure 1. Block Diagram

SO8 PACKAGE PIN DESCRIPTION

Pin #	Symbol	Description
1	GND	Ground
2	IN	Logic Level Input
3	OUT	Output
4	STAT	Status Output
5	V_D	Supply Voltage
6	V_D	Supply Voltage
7	V_D	Supply Voltage
8	V_D	Supply Voltage

Table 1. MAXIMUM RATINGS

Rating	Symbol	Value		Unit
		Min	Max	
DC Supply Voltage (Note 1)	V_D	−16	40	V
Peak Transient Input Voltage (Note 1) (Load Dump XX V, V_D = 14 V, ISO7637−2 pulse5)	V_{peak}		60	V
Input Voltage	V_{in}	−10	16	V
Input Current	I_{in}	−5	5	mA
Output Current (Note 1)	I_{out}	−	Internally Limited	A
Status Current	I_{status}	−5	5	mA
Power Dissipation Tc = 25°C (Note 1)	P_{tot}	1.5		W
Electrostatic Discharge (Note 1) (HBM Model 100 pF / 1500 Ω) Input Status Output V_D		 4 4 5 5		DC kV kV kV kV
Single Pulse Inductive Load Switching Energy (Note 1) V_D = 13.5 V; I_L = 0.5 A, T_{Jstart} = 150°C	E_{AS}	−	300	mJ
Operating Junction Temperature	T_J	−40	+150	°C
Storage Temperature	$T_{storage}$	−55	+150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Not subjected to production testing

Table 2. THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max. Value	Units
Thermal Resistance (Note 2) Junction−to−Lead Junction−to−Ambient (6 cm square pad size, FR−4, 2 oz Cu)	 R_{thJL} R_{thJA}	 31 84	°C/W

2. Reverse Output current has to be limited by the load to stay within absolute maximum ratings and thermal performance.

Table 3. ELECTRICAL CHARACTERISTICS (V_D = 13.5 V; −40°C < T_J < 150°C unless otherwise specified)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Operating Supply Voltage	V_D		5	–	34	V
Undervoltage Shutdown	V_{UV}				5	V
Undervoltage Restart	V_{UV_Res}				5.5	V
Overvoltage Protection	V_{OV}	I_D = 4 mA	41			V
On Resistance	R_{ON}	I_{out} = 0.3 A; 6 V < V_D < 40 V, T_J = 25°C I_{out} = 0.3 A; 6 V < V_D < 40 V, T_J = 150°C		250 450	350 700	mΩ
Standby Current	I_D	Off State, V_{in} = V_{out} = 0 V On State; V_{in} = 5 V, I_{out} = 0 A		13 1	35 1.7	μA mA
Output Leakage Current	$I_{L(off)}$				12	μA
INPUT CHARACTERISTICS						
Input Voltage − Low	V_{in_low}				0.8	V
Input Voltage − High	V_{in_high}		2.2			V
Input Hysteresis Voltage	V_{hyst}			0.3		V
Off State Input Current	I_{in_OFF}	V_{in} = 0.7 V	1		10	μA
On State Input Current	I_{in_ON}	V_{in} = 5.0 V	1		10	μA
Input Resistance (Note 3)	R_I		1.5	3.5		KΩ
Input Clamp Voltage	V_{in_cl}	I_{in} = 1 mA I_{in} = −1 mA	14 −18	16 −16	18 −14	V
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	t_{d_on}	to 90% V_{out}, R_L = 47 Ω			140	μs
Turn−Off Delay Time	t_{d_off}	to 10% V_{out}, R_L = 47 Ω			170	μs
Slew Rate On	dV_{out}/dt_{on}	10% to 30% Vout, R_L = 47 Ω			2	V / μs
Slew Rate Off	dV_{out}/dt_{off}	70% to 40% Vout, R_L = 47 Ω			2	V / μs
REVERSE BATTERY (Note 3)						
Reverse Battery	$-V_D$	Requires a 150 Ω Resistor in GND Connection			32	V
Forward Voltage	V_F	T_J = 150°C		0.6		V
STATUS PIN CHARACTERISTICS						
Status Output Voltage Low	V_{stat_low}	I_{stat} = 1.6 mA, T_J = −40°C to 25°C I_{stat} = 1.6 mA, T_J = 150°C (Note 3)			0.4 0.6	V
Status Leakage Current	$I_{stat\_leakage}$	V_{stat} = 5 V			10	μA
Status Invalid Time After Positive Input Slope	$T_{d(STAT)}$			300	700	μs
Status Clamp Voltage	V_{stat_cl}	I_{stat} = 1 mA I_{stat} = −1 mA		10 −1.4		V
PROTECTION FUNCTIONS (Note 4)						
Temperature Shutdown (Note 3)	T_{SD}		150	175	200	°C
Temperature Shutdown Hysteresis (Note 3)	T_{SD_hyst}			10		°C
Output Current Limit Initial Peak	I_{lim}	T_J = −40°C, V_D = 20 V (Note 3) T_J = 25°C T_J = 150°C (Note 3)	 0.7	 1.2 	2	A

3. Not subjected to production testing
4. To ensure long term reliability under heavy overload or short circuit conditions, protection and related diagnostic signals must be used together with a proper hardware/software strategy. If the devices operates under abnormal conditions this hardware/software solutions must limit the duration and number of activation cycles.

Table 3. ELECTRICAL CHARACTERISTICS (V_D = 13.5 V; −40°C < T_J < 150°C unless otherwise specified)

Rating	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
PROTECTION FUNCTIONS (Note 4)						
Repetitive Short Circuit Current Limit	$I_{lim(SC)}$	$T_J = T_{Jt}$ (Note 3)		1		A
Switch Off Output Clamp Voltage	V_{clamp}	I_D = 4 mA, V_{in} = 0 V	V_D − 41	V_D − 47		V
DIAGNOSTICS CHARACTERISTICS						
Short Circuit Detection Voltage	$V_{OUT(SC)}$			2.8		V
Openload Off State Detection Threshold	V_{OL}	V_{in} = 0 V	1.5		3.5	V
Openload Detection Current	$I_{L(OL)}$			5		μA

3. Not subjected to production testing
4. To ensure long term reliability under heavy overload or short circuit conditions, protection and related diagnostic signals must be used together with a proper hardware/software strategy. If the devices operates under abnormal conditions this hardware/software solutions must limit the duration and number of activation cycles.

Table 4. STATUS PIN TRUTH TABLE

Conditions	Input	Output	Status
Normal Operation	L H	L H	H H
Short Circuit to GND	L H	L L*	H L
Short to $V_{D\ (OFF\ State)}$	L H	H H	L H
Current Limitation	L H	L H**	H H
Overtemperature	L H	L L	H L
OFF State Open Load	L H	H H	L H

* Output = “L”; V_{OUT} < 2 V typ.
** Output = “H”; V_{OUT} > 2 V typ.

TYPICAL PERFORMANCE CHARACTERISTICS

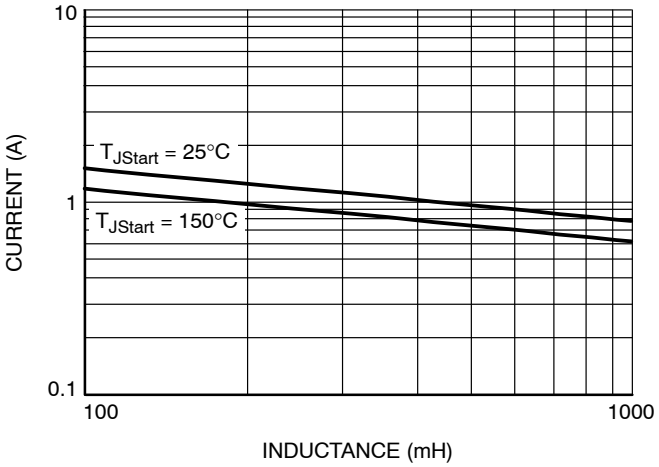


Figure 2. Maximum Single Pulse Switch Off Current vs. Inductance

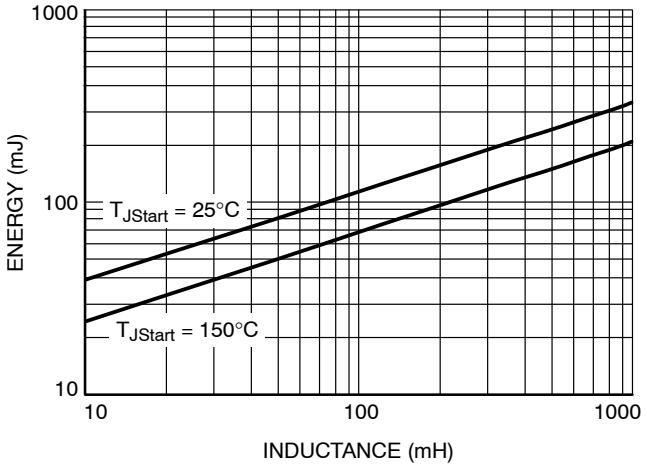


Figure 3. Maximum Single Pulse Switch Off Energy vs. Inductance

TYPICAL PERFORMANCE CHARACTERISTICS

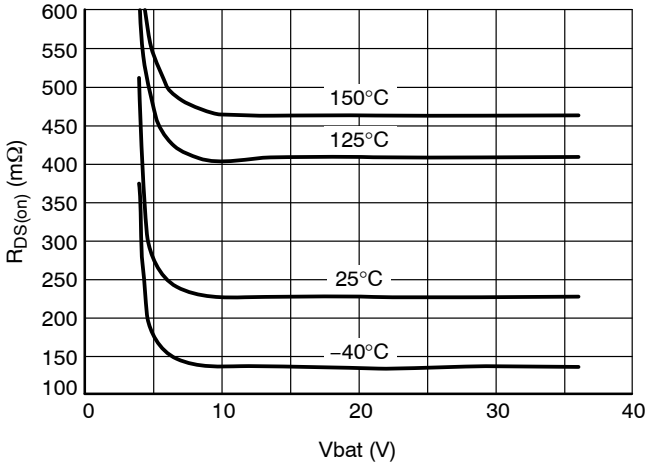


Figure 4. $R_{DS(on)}$ Over Temp and Battery

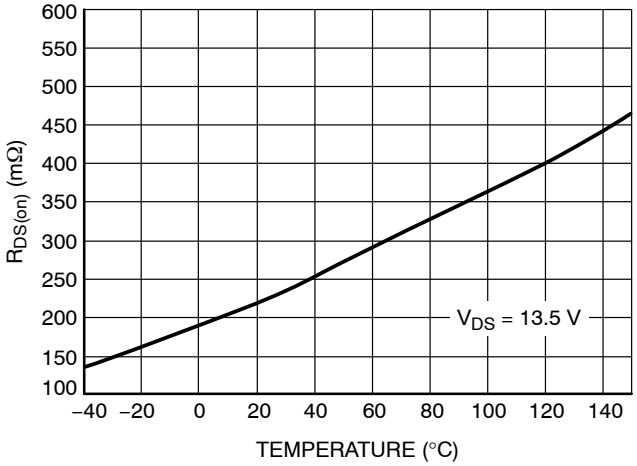


Figure 5. $R_{DS(on)}$ vs. Temperature

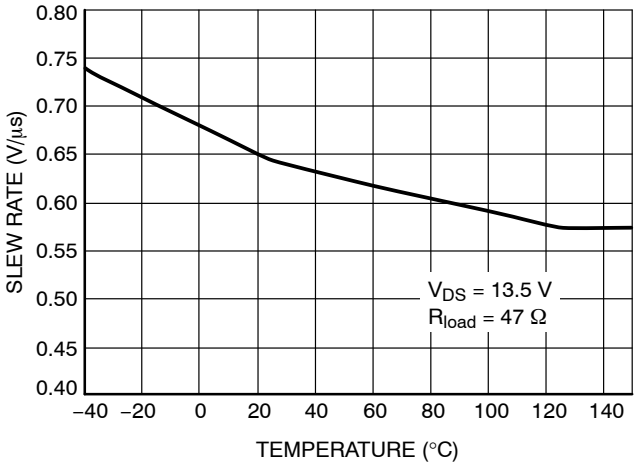


Figure 6. Slew Rate On vs. Temperature

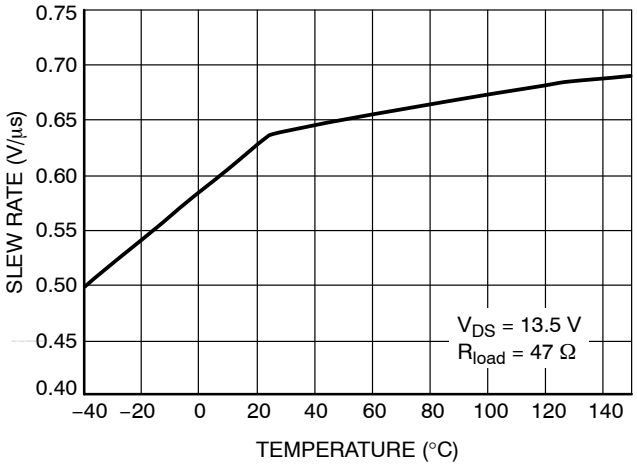


Figure 7. Slew Rate Off vs. Temperature

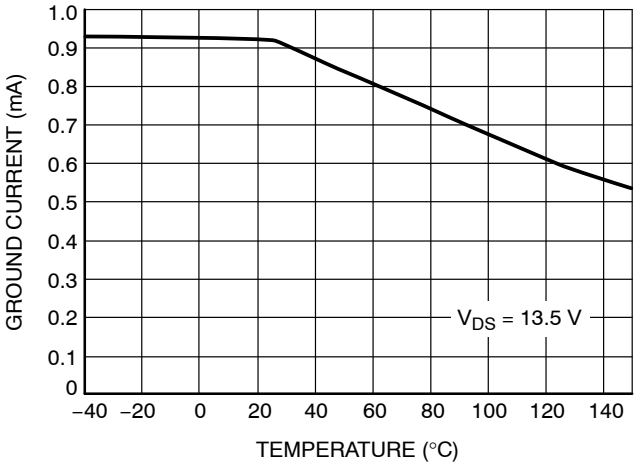


Figure 8. On State Ground Current vs. Temp

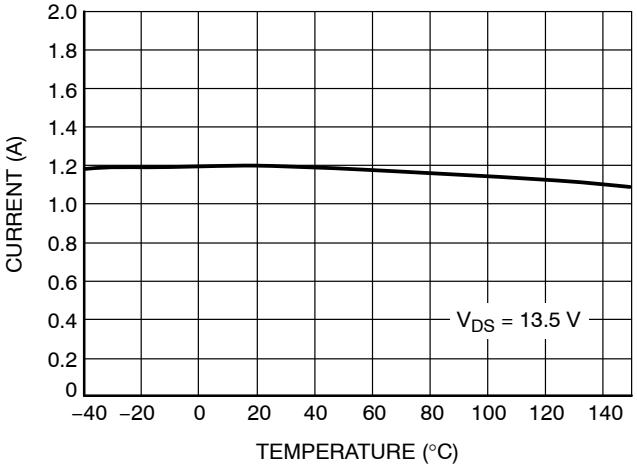
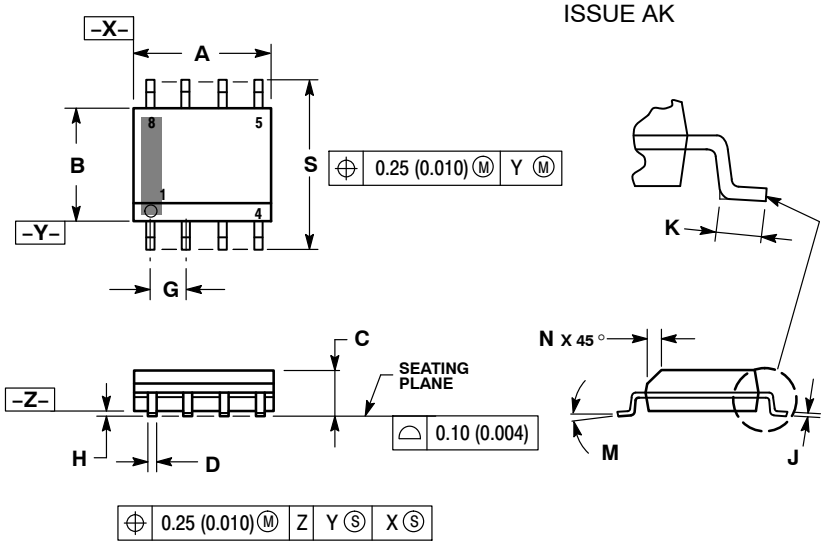


Figure 9. Current Limit vs. Temperature

PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AK

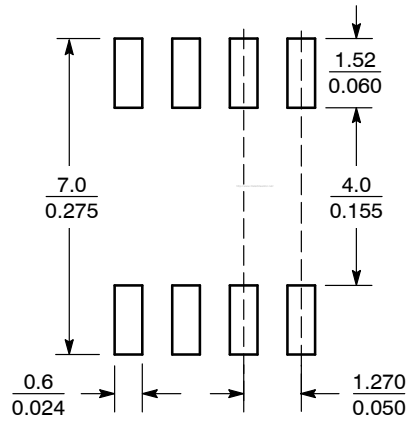


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

STYLE 11:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

SOLDERING FOOTPRINT*



SCALE 6:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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