數据資料

精确的死區時間控制的橋型控制器

ISL6745是成本低、雙端控制器。主要應用于全橋和半橋型拓扑結构的電源和線調節的總線變換器。器件的主要特點是精确的開關頻率控制、可調軟啓動、和過流關斷保護。另外，ISL6745可精确地調整MOSFET不交迭的死區時間低至35 ns，允許電源設計師优化開環總線變換器的效率。ISL6745還包括電壓控制輸入适合于閉環PWM控制和線壓前饋控制。

ISL6745的低啓動和運作電流特點, 使其在AC-DC和DC-DC應用容易地偏壓。

這先進的BiCMOS設計特點是可調開關頻率高至1MHz，1A FET 驅動器，和非常低的傳輸延遲适合于過流快反 應。

定購資料

零件號碼	溫度范圍 (°C)	包裝	包裝圖號#
ISL6745AU	-40 to 105	10 Ld MSOP	M10.118
ISL6745AUZ (See Note)	-40 to 105	10 Ld MSOP (Pb-free)	M10.118

Add -T suffix to part number for tape and reel packaging

NOTE: Intersil Pb-free products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020C.

主要特點

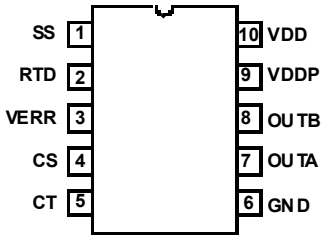
- 精确的占空比和死區時間控制
- 100µA啓動電流
- 可調延遲過流關斷和重新啟動
- 可調振蕩器頻率高至 2MHz
- 1A MOSFET門极驅動器
- 可調軟啓動
- 內部過熱保護
- 控制到輸出的延遲是35ns
- 体積小和极少的外部元件
- 輸入欠壓保護
- 不含Pb的包裝

應用

- 半橋和全橋型拓扑結构的變換器
- 線調節的總線變換器
- AC-DC電源
- 通信、信息和檔案服務器的電源

插腳引線 (頂視圖)

ISL6745 (MSOP)



CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.
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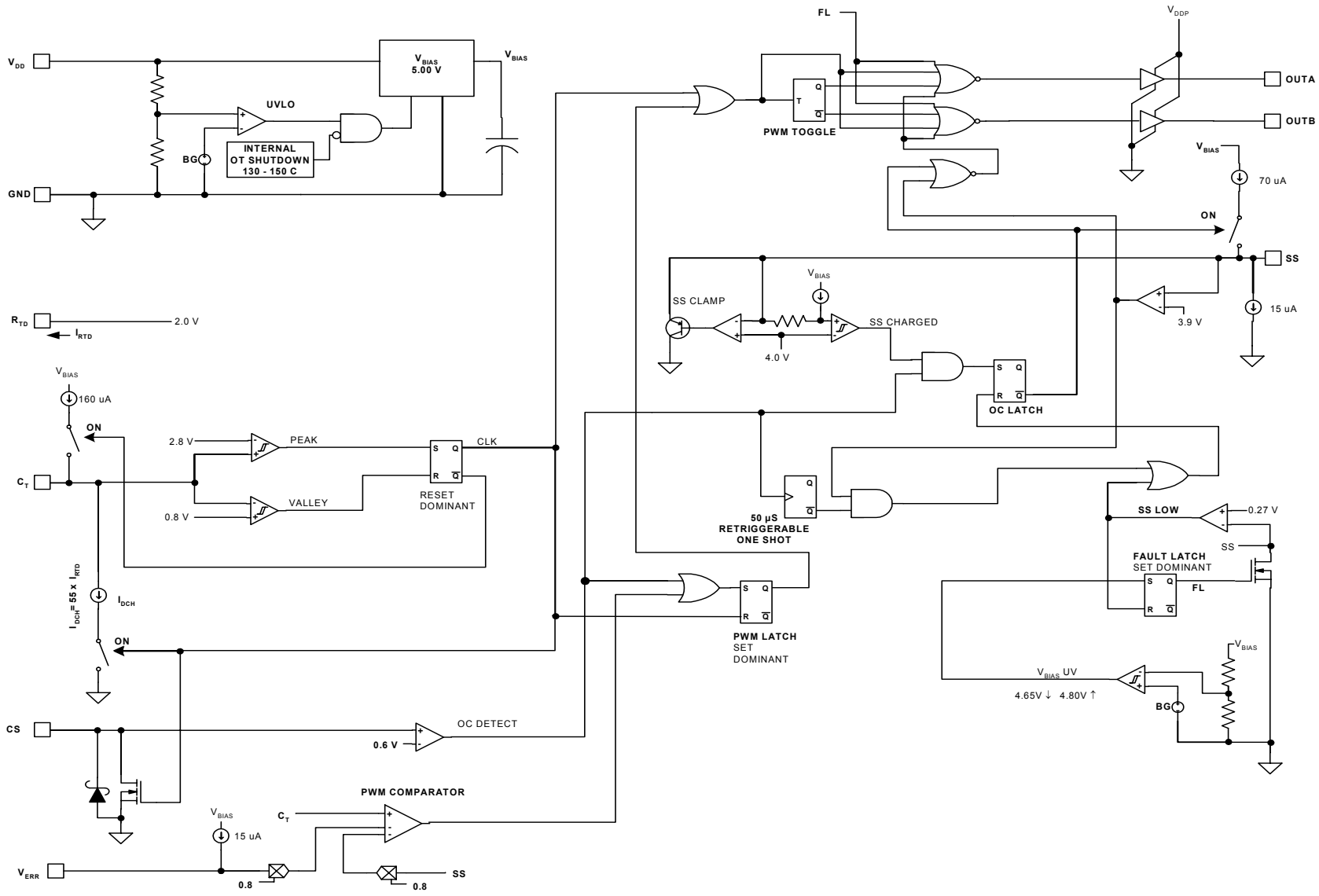


ISL6745 內部電路結构

額定值

Supply Voltage, V_{DD} ----------GND-0.3V to +20V
OUTA, OUTB ---------- GND -0.3V to V_{DD}
Signal Pins---------- GND-0.3V to 5V
Peak GATE Current---------- 1A
ESD Classification
Human Body Model (per JEDEC22 std. Method A114-B)---Class 2
Machine Model (Per JEDEC22 std. Method A115-A)---------Class A

運行條件

Supply Voltage Range (Typical) ----------9-16VDC
Temperature Range
ISL6745AU---------- -40°C to 105°C

熱性能的資料

Thermal Resistance (Typical, Note 1)----------θ_{JA} (°C/W)
10 Lead MSOP ---------- 128
Maximum Junction Temperature ---------- -55°C to 150°C
Maximum Storage Temperature Range - -65°C to 150°C
Maximum Lead Temperature (Soldering 10s)------300°C

CAUTION: Stress above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied.

NOTES:

1) θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

2) All voltages are to be measured with respect to GND, unless otherwise specified.

電气規范 Electrical Specifications

Recommended Operating Conditions, Unless Otherwise Noted. Refer to Block Diagram and Typical Application Schematic. $9V<V_{DD}<16V$, R_{TD}= 51.1KΩ, C_T = 470pF, T_A = -40°C to 105°C (Note 4), Typical values are at T_A= 25°C.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
SUPPLY VOLTAGE					
Start-Up Current, I_{DD}	V_{DD}< START Threshold	-	-	175	µA
Operating Current, I_{DD}	$C_{OUTA, B}$ = 1nF	-	5	8.5	mA
UVLO START Threshold		5.9	6.3	6.6	V
UVLO STOP Threshold		5.3	5.7	6.3	V
Hysteresis		-	0.6	-	V
CURRENT SENSE					
Current Limit Threshold		0.55	0.6	0.65	V
CS to OUT Delay	(Note 4)	-	35	-	ns
CS Sink Current		8	10	-	mA
Input Bias Current		-1	-	1	µA
PULSE WIDTH MODULATOR					
Minimum Duty Cycle	V_{ERRO}R < C_T Offset	-	-	0	%
Maximum Duty Cycle	C_T = 470pF, R_{TD} = 51.1KΩ	-	94	-	%
	C_T = 470pF, R_{TD} = 1.1KΩ (Note 4)	-	99	-	%
V_{ERR} to PWM Comparator Input Gain		-	0.8	-	V/V
CT to PWM Comparator Input Gain	(Note 4)	-	1	-	V/V
SS to PWM Comparator Input Gain	(Note 4)	-	0.8	-	V/V
OSCILLATOR					
Charge Current	T_A = 25°C	143	156	170	µA
R_{TD} Voltage		1.925	2	2.075	V
Discharge Current Gain		45	-	65	µA/µA

電气规范 **Electrical Specifications** Recommended Operating Conditions, Unless Otherwise Noted. Refer to Block Diagram and Typical Application Schematic. 9V<V_{DD}<16V, R_{TD}= 51.1KΩ, C_T = 470pF, T_A = -40°C to 105°C (Note 4), Typical values are at T_A= 25°C. **(Continued)**

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
C_T Valley Voltage		0.75	0.8	0.85	V
C_T Peak Voltage		2.70	2.80	2.90	V
SOFT-START					
Net Charging Current		45	-	68	µA
SS Clamp Voltage		3.8	4.0	4.2	V
Overcurrent Shutdown Threshold Voltage	(Note 4)	-	3.9	-	V
Overcurrent Discharge Current		12	15	23	µA
Reset Threshold Voltage	(Note 4)	0.25	0.27	0.30	V
OUTPUT					
High Level Output Voltage (VOH)	V_{DD} – V_{OUTA} or V_{OUTB}, I_{OUT} = -100mA	-	0.5	2.0	V
Low Level Output Voltage (VOL)	I_{OUT} = 100mA	-	0.5	1.0	V
Rise Time	C_{GATE} = 1nF, V_{DD} = 12V	-	17	60	ns
Fall Time	C_{GATE} = 1nF, V_{DD} = 12V	-	20	60	ns
THERMAL PROTECTION					
Thermal Shutdown	(Note 4)	-	145	-	°C
Thermal Shutdown Clear	(Note 4)	-	130	-	°C
Hysteresis, Internal Protection	(Note 4)	-	15	-	°C

NOTES:

3. Specifications at -40°C are guaranteed by design, not production tested.

4. Guaranteed by design, not 100% tested in production.

Typical Performance Curves

典型性能曲線圖

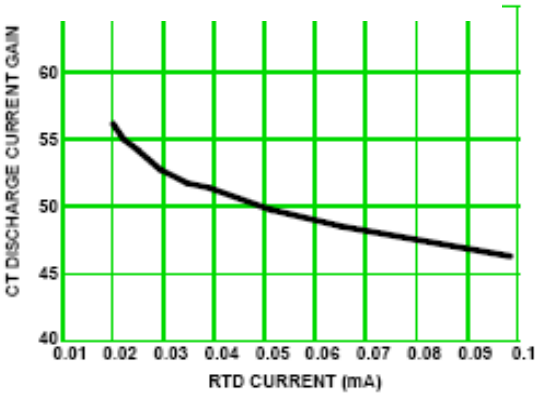


FIGURE 1. OSCILLATOR CT DISCHARGE CURRENT GAIN

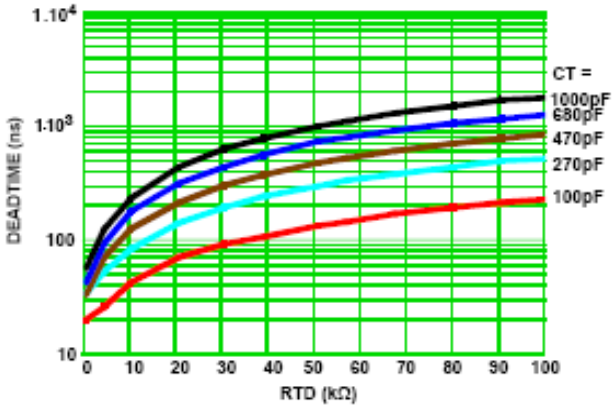


FIGURE 2. DEADTIME vs CAPACITANCE

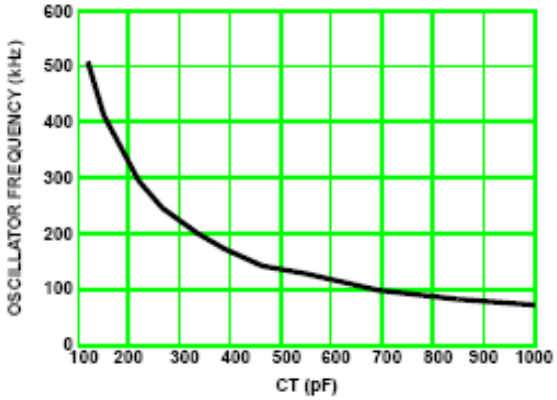


FIGURE 3. CAPACITANCE vs OSCILLATOR FREQUENCY (RTD = 49.9kΩ)

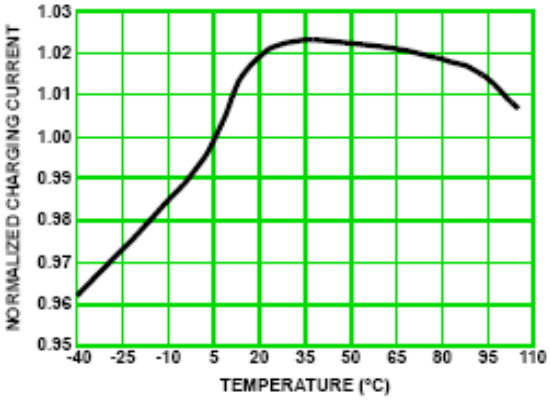


FIGURE 4. CHARGE CURRENT vs TEMPERATURE

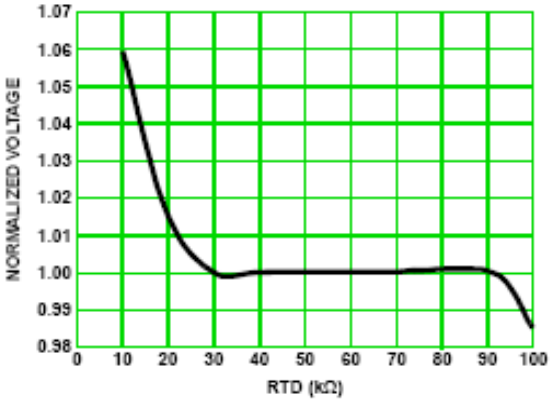


FIGURE 5. TIMING CAPACITOR VOLTAGE vs RTD

ISL6745各管腳簡介

V_{DD}

V_{DD}爲電源輸入端。要优化抗扰度，用一個陶瓷電容器盡可能靠近并挎接在V_{DD}和GND引腳。

IC總供應電流，I_{DD}，取决于OUTA和OUTB輸出端的負載。I_{DD}電流是靜態電流和平均輸出電流的總和。平均輸出電流(I_{OUT})与操工作頻率(F_{SW})和每輸出端的負載電容的電荷量(Q)成 正比， 其值可用下式 計 算:

$$I_{OUT} = 2 \times Q \times F_{SW} \quad \text{(EQ. 1)}$$

R_{TD}

這是振蕩器定時電容放電電流控制引腳。一個電阻器應連接在這引腳和GND之間。而流經這個電阻的電流決定放電電流的大小。放電電流的通常值則是這電流的55倍。PWM死區時間由定時電容放電時間決定。

C_T

振蕩器定時電容應連接在這引腳和GND之 間。

CS

這是過流保護比較器的輸入端。過流比較器門限值設置爲典型值0.600V。在每個開關周期的末端，CS引腳短接于GND。根据電流傳感源阻抗，由于內部時鐘和外部電力開關間的延遲，可能要求串聯一個電阻。

超出過流門限值會啓動延遲關斷程序。一旦檢測出過流情況，軟啓動充電電流源就會被截止。而軟啓動電容通過15A電流源放電，如果軟啓動電壓降至于3.9V(可承受的過流門限值)關斷條件出現，OUTA和OUTB輸出會強制降低。當軟啓動電壓降至0.27V(重新設置門限值)，一個新軟啓動周期開始。如果过流情况中断，且在50μs时间内未达到关断门限值(3.9V)，过流关断是不会发生。软启动充电电流重新运行且软启动电压复位。

GND

器件上所有功能和電源地都以這個引腳爲基准。由于高峰值電流和高頻工作，布局必須是低阻抗的。故建議使用地線板塊和短接線。

OUTA and OUTB

OUTA和OUTB爲交替半周期輸出端。每個輸出具有1A峰值電流的輸出能力可驅動MOSFETs或MOSFET驅動器，且以非常低 的阻抗降低過沖和下沖。

SS

在這個引腳与GND之間連接軟啟動定時電容器來控制軟啟動的時間。電容值決定啟動時占空比的增長率，且控制過流關斷延遲和過流与短路間歇再啟動周期。

功能概述

主要特點

ISL6745為那些以低成本的橋型拓扑結构且要求准确頻率和死區時間控制的應用提供了一個极佳的選擇。它有很多特點，其中有1AFET驅動器、可調軟啟動、過流保護和內部過熱保護，因而ISL6745能以最少量的外部元件做出一個高度靈活的設計。

振荡器

ISL6745通過改變電阻R_{TD}和電容C_T來調振蕩器頻率高達2M HZ。開關周期是定時電容充電和放電時間之和。充電時間由C_T和內部電流源(在式中采用160μA)決定，而放電時間取決于R_{TD}和 C_T。

$$T_C \approx 1.25 \times 10^4 \bullet C_T \quad s \quad \text{(EQ.2)}$$

$$T_D \approx \frac{1}{CTDischargeCurrentGain} \bullet R_{TD} \bullet C_T \quad s \quad \text{(EQ. 3)}$$

$$T_{OSC} = T_C + T_D = \frac{1}{F_{OSC}} \quad s \quad \text{(EQ. 4)}$$

T_C和T_D分別是大概的充電和放電時間，T_{OSC}是振蕩器自由運行周期，而F_{OSC}是振蕩器頻率。放電電流增益(DischargeCurrentGain=45to65)可在第3頁的表(或Figure1)找到。一個輸出的開關周期等于二個振蕩器周期。由于傳輸延遲約5ns，實際時間比所計算的時間稍微長。這個延遲直接增加到開關時間，且引起定時電容峰值和谷電壓門限過沖，因而增大了定時電容峰-峰的電壓。另外，如果使用非 常低充電和放電電流，

時間誤差將會因C_T引腳處的輸入阻抗而增加。

EQ.2至4可幫助估計振蕩器頻率。在實踐上,寄生電容會影響全部的C_T電容，R_{TD}電壓的變化和充電電流遍及溫度的變化及其他變化是不可被忽視的。這些對頻率的影響最好在真的電路板里評价。EQ.2依据于基本的電容電流公式，I=C*dV/dt。

根据R_{TD}電壓的變化(如圖4)和充電電流變化(如圖5)，公式2的結果將會不同計算出的結果。典型性能曲線和上述的公式一起 更精确地估計工作頻率。

最大占空比（D_{MAX}）和死區時間（D_T）可用以下公式計算

$$D_{MAX} = T_C / T_{OSC} \quad \text{(EQ. 5)}$$

$$D_T = T_{OSC} \times (1 - D_{MAX}) \quad \text{(EQ. 6)}$$

軟啓動運作

ISL6745使用外部電容和內部電流電源來作軟啟動。軟啟動降低啟動期間的電壓和浪涌電流。

在用以驅動PWM門控的軟啟動比較器里，振蕩器電容C_T信號与軟啟動SS電壓作比較。當軟啟動電壓（SS）少于2.8V時，占空比會受到限制。輸出脈寬隨著軟啟動電容電壓的增加而增加。這使軟啟動期間的占空比可從零增加到最大脈寬。當軟啟動電壓超過2.8V，軟啟動完成。軟啟動開始于起動或因過流關斷而复位時。 軟啟動電壓被鉗位在4V.

門极驅動器

ISL6745可灌出和吸收1A峰值電流，且可連接一個MOSFET驅動器如ISL6700作電平轉移之用。如要限制峰值電流通過IC，一個外部電阻應連接在IC的推拉輸出(OUTA或OUTB引腳)和MOSFET的門极之間。而這個小串聯電阻能阻尼由線組寄生 電感和FET的輸入電容的共振所產生的振蕩。

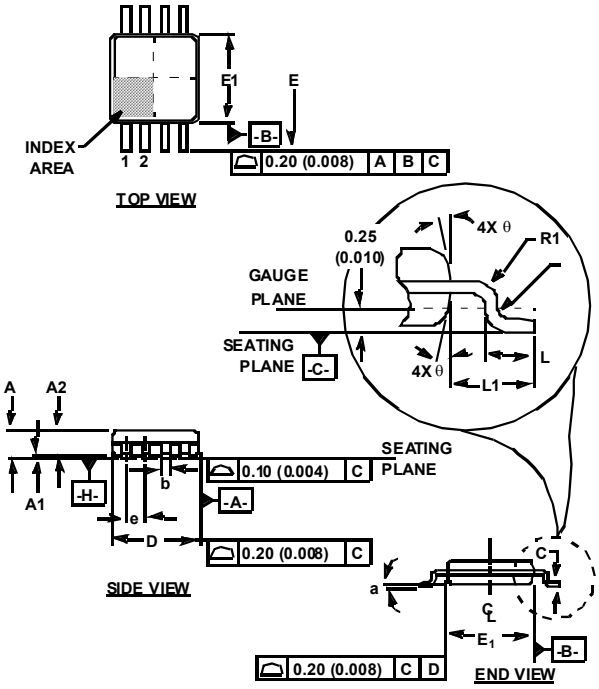
過流運作

軟啟動周期完成后，過流延遲關斷保護才啟動。如果檢測出過流情況，軟啟動充電電流電源就會中止，且軟啟動電容通過15A電源放電。過流情況停止后，在50μs時間內，如果軟啟動電容器放電至3.9V，輸出停止。這种狀態持續到軟啟動電壓降至270mV，開始新軟啟動周期。如果在軟啟動電壓降至的3.9V前，且過流情況停止至少50μs，軟啟動充電電流會恢复正常運作，而軟啟動電壓會复位。

過熱保護

內熱傳感器保護器件芯片結溫不超出145°C，而熱遲滯約15 °C。

Mini Small Outline Plastic Packages (MSOP)



NOTES:

1. These package dimensions are within allowable dimensions of JEDEC MO-187BA.
2. Dimensioning and tolerancing per ANSI Y14.5M-1994.
3. Dimension “D” does not include mold flash, protrusions or gate burrs and are measured at Datum Plane. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
4. Dimension “E1” does not include interlead flash or protrusions and are measured at Datum Plane. Interlead flash and protrusions shall not exceed 0.15mm (0.006 inch) per side.
5. Formed leads shall be planar with respect to one another within 0.10mm (.004) at seating Plane.
6. “L” is the length of terminal for soldering to a substrate.
7. “N” is the number of terminal positions.
8. Terminal numbers are shown for reference only.
9. Dimension “b” does not include dambar protrusion. Allowable dambar protrusion shall be 0.08mm (0.003 inch) total in excess of “b” dimension at maximum material condition. Minimum space between protrusion and adjacent lead is 0.07mm (0.0027 inch).
10. Datums -A- and -B-to be determined at Datum plane -H- .
11. Controlling dimension: MILLIMETER. Converted inch dimensions are for reference only

M10.118 (JEDEC MO-187BA)

10 LEAD SHRINK NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.037	0.043	0.94	1.10	-
A1	0.002	0.006	0.05	0.15	-
A2	0.030	0.037	0.75	0.95	-
b	0.007	0.011	0.18	0.27	9
c	0.004	0.008	0.09	0.20	-
D	0.116	0.120	2.95	3.05	3
E1	0.116	0.120	2.95	3.05	4
e	0.020 BSC		0.50 BSC		-
E	0.187	0.199	4.75	5.05	-
L	0.016	0.028	0.40	0.70	6
L1	0.037 REF		0.95 REF		-
N	10		10		7
R	0.003	-	0.07	-	-
R1	0.003	-	0.07	-	-
θ	5^o	15^o	5^o	15^o	
α	0^o	6^o	0^o	6^o	-

Rev.0 12/02

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