ICL7665

µP Voltage Monitor with Dual Over/Undervoltage Detection

Microprocessor Voltage Monitor with Dual Over/Undervoltage Detection

Description

The ICL7665 warns microprocessors (µPs) of overvoltage and undervoltage conditions. It draws a typical operating current of only 3µA. The trip points and hysteresis of the two voltage detectors are individually programmed via external resistors to any voltage greater than 1.3V. The ICL7665 will operate from any supply voltage in the 1.6V to 16V range, while monitoring voltages from 1.3V to several hundred volts. The Maxim ICL7665A is an improved version with a 2%-accurate V_{SET1} threshold and guaranteed performance over temperature.

The 3µA quiescent current of the ICL7665 makes it ideal for voltage monitoring in battery-powered systems. In both battery- and line-powered systems, the unique combination of a reference, two comparators, and hysteresis outputs reduces the size and component count of many circuits.

Key Features

- µP Over/Undervoltage Warning
- Improved Second Source
- Dual Comparator with Precision Internal Reference
- 3µA Operating Current
- 2% Threshold Accuracy (ICL7665A)
- 1.6V to 16V Supply Voltage Range
- On-Board Hysteresis Outputs
- Externally Programmable Trip Points
- Monolithic, Low-Power CMOS Design

Applications/Uses

µP Voltage Monitoring
Battery-Backup Switching
High/Low Temperature, Pressure, Voltage Alarms
Low-Battery Detection
Over/Undervoltage Protection
Power Supply Fault Monitoring
Power-Fail and Brownout Detection

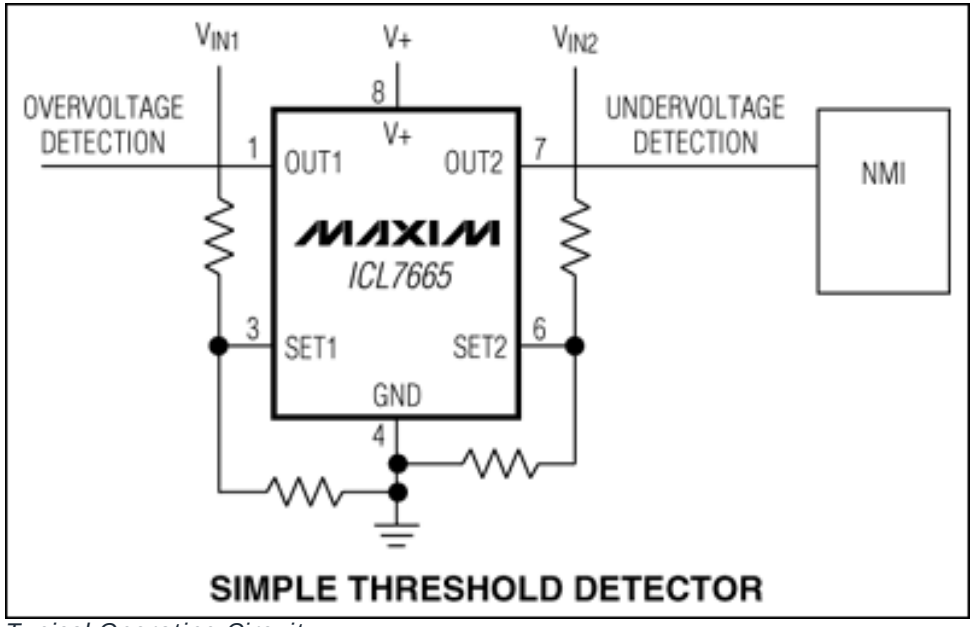
Key Specifications: Supervisors (2 Monitored Voltages)

Part Number	Interface	Reset Threshold Range (V)	Active-Low Reset Output	Active-High Reset Output	Min. Reset Timeout Range	Watchdog Feature	Supervisor Features	Reset Thresh. Acc. (% @+25°C)	Max. I_{CC} (µA)	
ICL7665	R/C Adjustable	1.2 to 1.8 1.8 to 2.5 2.5 to 3.3 3.3 to 5.5	Open Drain	Open Drain	<1ms	No Watchdog	Adjustable Reset Input Overvoltage/Window Monitor	2	15	

See All Supervisors (2 Monitored Voltages) (70)

Notes:
**This pricing is BUDGETARY, for comparing similar parts. Prices are in U.S. dollars and subject to change. Quantity pricing may vary substantially and international prices may differ due to local duties, taxes, fees, and exchange rates. For volume-specific prices and delivery, please see the price and availability page or contact an authorized distributor.

Diagram



Typical Operating Circuit

Evaluation Kits

none

Reliability Reports

Show FIT data for:
Reliability Report: ICL7665xxxx.pdf

Software / Models

none

Ordering Information

Notes:

1. Other options and links for purchasing parts are listed at:
2. Didn't Find What You Need? Ask our applications engineers. Expert assistance in finding parts, usually within one business day.
3. Part number suffixes: T or T&R = tape and reel; + = RoHS/lead-free; # = RoHS/lead-exempt. More: SeeFull Data Sheet or Part Naming Conventions.
4. * Some packages have variations, listed on the drawing. "PkgCode/Variation" tells which variation the product uses. Note that "+", "#", "-" in the part number suffix describes RoHS status. Package drawings may show a different suffix character.

Devices: 1-33 of 33

ICL7665	Free Sample	Buy	Package: TYPE PINS FOOTPRINT DRAWING CODE/VAR *	Temp	RoHS/Lead-Free? Materials Analysis
ICL7665ACJA			Ceramic DIP;8 pin; Dwg: 21-0045 (PDF) Use pkgcode/variation: J8-2*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665CJA			Ceramic DIP;8 pin; Dwg: 21-0045 (PDF) Use pkgcode/variation: J8-2*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665BCJA			Ceramic DIP;8 pin; Dwg: 21-0045 (PDF) Use pkgcode/variation: J8-2*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665IJA			Ceramic DIP;8 pin; Dwg: 21-0045 (PDF) Use pkgcode/variation: J8-2*	-20°C to +85°C	RoHS/Lead-Free: No Materials Analysis
ICL7665ACJA/HR			Ceramic DIP;8 pin; Dwg: 21-0045 (PDF) Use pkgcode/variation: J8-2*	-55°C to +125°C	RoHS/Lead-Free: No Materials Analysis
ICL7665AC/D					See data sheet
ICL7665C/D					See data sheet

ICL7665BC/D					See data sheet
ICL7665BCTV			Metal Can-TO;8 pin; Dwg: 21-0022 (PDF) Use pkgcode/variation: T99-8*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665CTV			Metal Can-TO;8 pin; Dwg: 21-0022 (PDF) Use pkgcode/variation: T99-8*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665ACTV			Metal Can-TO;8 pin; Dwg: 21-0022 (PDF) Use pkgcode/variation: T99-8*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665AEPA+			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8+1*	-40°C to +85°C	RoHS/Lead-Free: Lead Free Materials Analysis
ICL7665ACPA+			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8+1*	0°C to +70°C	RoHS/Lead-Free: Lead Free Materials Analysis
ICL7665ACPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665CPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665BCPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	0°C to +70°C	RoHS/Lead-Free: No Materials Analysis
ICL7665AEPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	-40°C to +85°C	RoHS/Lead-Free: No Materials Analysis
ICL7665IPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	-40°C to +85°C	RoHS/Lead-Free: No Materials Analysis
ICL7665EPA			PDIP;8 pin; Dwg: 21-0043 (PDF) Use pkgcode/variation: P8-1*	-40°C to +85°C	RoHS/Lead-Free: No Materials Analysis
ICL7665CSA+			SOIC;8 pin; Dwg: 21-0041 (PDF) Use pkgcode/variation: S8+4*	0°C to +70°C	RoHS/Lead-Free: Lead Free Materials Analysis
ICL7665CSA+T			SOIC;8 pin; Dwg: 21-0041 (PDF) Use pkgcode/variation: S8+4*	0°C to +70°C	RoHS/Lead-Free: Lead Free Materials Analysis

Microprocessor Voltage Monitor with Dual Over/Undervoltage Detection

General Description

The ICL7665 warns microprocessors (µPs) of overvoltage and undervoltage conditions. It draws a typical operating current of only 3µA. The trip points and hysteresis of the two voltage detectors are individually programmed via external resistors to any voltage greater than 1.3V. The ICL7665 will operate from any supply voltage in the 1.6V to 16V range, while monitoring voltages from 1.3V to several hundred volts. The Maxim ICL7665A is an improved version with a 2%-accurate V_{SET1} threshold and guaranteed performance over temperature.

The 3µA quiescent current of the ICL7665 makes it ideal for voltage monitoring in battery-powered systems. In both battery- and line-powered systems, the unique combination of a reference, two comparators, and hysteresis outputs reduces the size and component count of many circuits.

Applications

µP Voltage Monitoring
Low-Battery Detection
Power-Fail and Brownout Detection
Battery Backup Switching
Power-Supply Fault Monitoring
Over/Undervoltage Protection
High/Low Temperature, Pressure, Voltage Alarms

Features

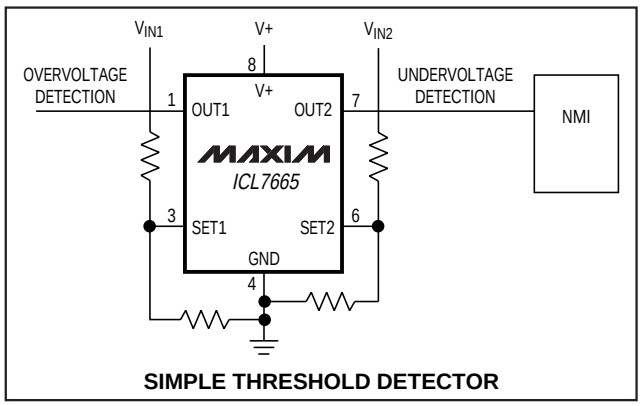
- **µP Over/Undervoltage Warning**
- **Improved Second Source**
- **Dual Comparator with Precision Internal Reference**
- **3µA Operating Current**
- **2% Threshold Accuracy (ICL7665A)**
- **1.6V to 16V Supply Voltage Range**
- **On-Board Hysteresis Outputs**
- **Externally Programmable Trip Points**
- **Monolithic, Low-Power CMOS Design**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
ICL7665CPA	0°C to +70°C	8 Plastic DIP
ICL7665ACPA	0°C to +70°C	8 Plastic DIP
ICL7665BCPA	0°C to +70°C	8 Plastic DIP
ICL7665CSA	0°C to +70°C	8 SO
ICL7665ACSA	0°C to +70°C	8 SO
ICL7665BCSA	0°C to +70°C	8 SO
ICL7665CJA	0°C to +70°C	8 CERDIP
ICL7665ACJA	0°C to +70°C	8 CERDIP
ICL7665BCJA	0°C to +70°C	8 CERDIP

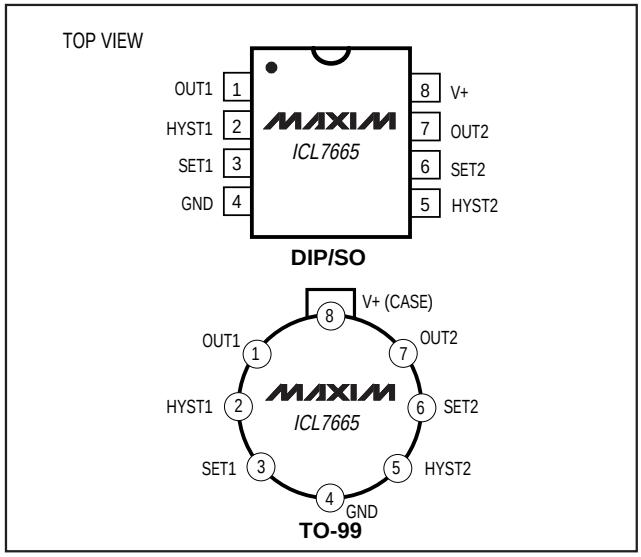
Ordering Information continued on last page.

Typical Operating Circuit



SIMPLE THRESHOLD DETECTOR

Pin Configurations



DIP/SO

TO-99

Microprocessor Voltage Monitor with Dual Over/Undervoltage Detection

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Note 1) .....-0.3V to +18V
Output Voltages OUT1 and OUT2
(with respect to GND) (Note 1) .....-0.3V to +18V
Output Voltages HYST1 and HYST2
(with respect to V+) (Note 1) .....+0.3V to -18V
Input Voltages SET1 and SET2
(Note 1).....(GND - 0.3V) to (V+ + 0.3V)
Maximum Sink Output Current
OUT1 and OUT2.....25mA
Maximum Source Output Current
HYST1 and HYST2 .....-25mA

Continuous Power Dissipation (T_A = +70°C)
Plastic DIP (derate 9.09mW/°C above +70°C) 727mW
SO (derate 5.88mW/°C above +70°C) 471mW
CERDIP (derate 8.00mW/°C above +70°C) 640mW
TO-99 (derate 6.67mW/°C above +70°C) 533mW
Operating Temperature Ranges
ICL7665C_ _.....0°C to +70°C
ICL7665I_ _.....-20°C to +85°C
ICL7665E_ _.....-40°C to +85°C
Storage Temperature Range .....-65°C to +160°C
Lead Temperature (soldering, 10sec) .....+300°C

Note 1: Due to the SCR structure inherent in the CMOS process used to fabricate these devices, connecting any terminal to voltages greater than (V+ + 0.3V) or less than (GND - 0.3V) may cause destructive latchup. For this reason, we recommend that inputs from external sources that are not operating from the same power supply **not** be applied to the device before its supply is established, and that in multiple supply systems, the supply to the ICL7665 be turned on first. If this is not possible, currents into inputs and/or outputs must be limited to ±0.5mA and voltages must not exceed those defined above.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V+ = 5V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Operating Supply Voltage	V+	ICL7665	T_A = +25°C		1.6		16	V
			T_A = T_{MIN} to T_{MIN}		1.8		16	
		ICL7665A	T_A = T_{MIN} to T_{MIN}		2.0		16	
		ICL7665B	T_A = +25°C		1.6		10	
			T_A = T_{MIN} to T_{MIN}		1.8		10	
Supply Current	I+	GND ≤ V_{SET1}, V_{SET2} ≤ V+, all outputs open circuit	ICL7665, T_A = +25°C; ICL7665A, T_A = T_{MIN} to T_{MAX}	V+ = 2V		2.5	10	µA
				V+ = 9V		2.6	10	
				V+ = 15V		2.9	15	
			ICL7665B, T_A = +25°C	V+ = 2V		2.5	10	
				V+ = 9V		2.6	10	
Input Trip Voltage	V_{SET}	ICL7665, ICL7665B, T_A = +25°C		V_{SET1}	1.150	1.300	1.450	V
				V_{SET2}	1.200	1.300	1.400	
		ICL7665A, T_A = +25°C		V_{SET1}	1.275	1.300	1.325	
				V_{SET2}	1.225	1.300	1.375	
		ICL7665A, T_A = T_{MIN} to T_{MAX}		V_{SET1}	1.250	1.300	1.350	
				V_{SET2}	1.215	1.300	1.385	
V_{SET} Tempco						100		ppm/°C
Supply Voltage Sensitivity of V_{SET1}, V_{SET2}		R_{OUT1}, R_{OUT2}, R_{HYST1}, R_{HYST2} = 1MΩ				0.004		%/V

ELECTRICAL CHARACTERISTICS (continued)

(V+ = 5V, T_A = +25°C, unless otherwise noted.)

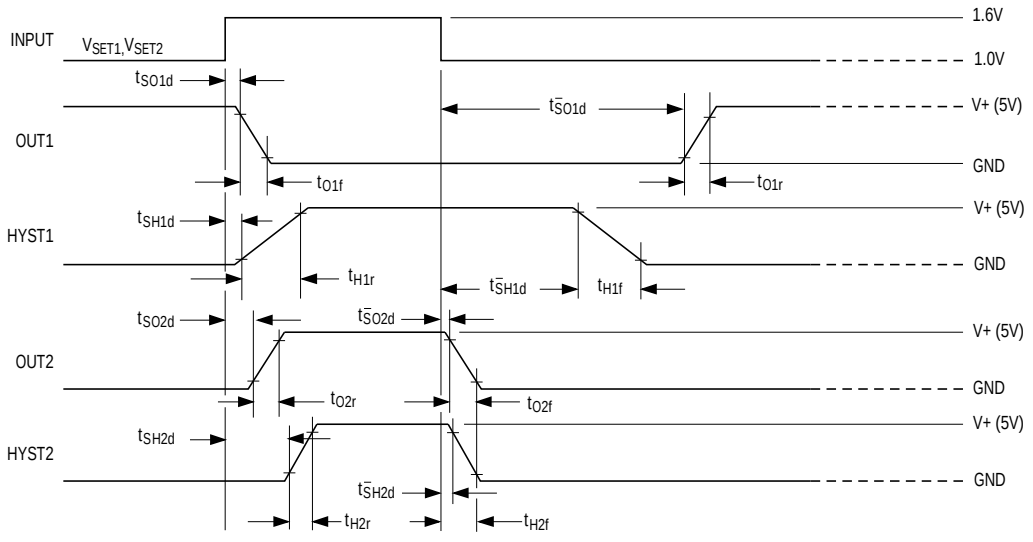
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Leakage Current	I_{OLK}, I_{HLK}	All grades, V_{SET} = 0V or $V_{SET} \geq$ 2V, T_A = +25°C	OUT1, OUT2		10	200	nA
			HYST1, HSYT2		-10	-100	
		ICL7665, ICL7665A, V+ = 15V, $T_A = T_{MIN}$ to T_{MAX}	OUT1, OUT2			2000	
			HYST1, HSYT2			-500	
		ICL7665B, V+ = 9V, $T_A = T_{MIN}$ to T_{MAX}	OUT1, OUT2			2000	
			HYST1, HSYT2			-500	
V_{OUT1} Saturation Voltage		V_{SET1} = 2V, I_{OUT1} = 2mA	ICL7665, ICL7665B: V+ = 2V		0.20	0.50	V
			ICL7665A: V+ = 2V		0.20		
			All grades: V+ = 5V		0.10	0.30	
			ICL7665, ICL7665A: V+ = 15V		0.06	0.20	
			ICL7665B: V+ = 9V		0.06	0.25	
V_{HYST1} Saturation Voltage		V_{SET1} = 2V, I_{HYST1} = -0.5mA	All grades: V+ = 2V		-0.15	-0.30	V
			All grades: V+ = 5V		-0.05	-0.15	
			ICL7665, ICL665A: V+ = 15V		-0.02	-0.10	
			ICL7665B: V+ = 9V		-0.02	-0.15	
V_{OUT2} Saturation Voltage		V_{SET2} = 0V, I_{OUT2} = 2mA	All grades: V+ = 2V		0.20	0.50	V
			All grades: V+ = 5V		0.15	0.30	
			ICL7665, ICL665A: V+ = 15V		0.11	0.25	
			ICL7665B: V+ = 9V		0.11	0.30	
V_{HYST2} Saturation Voltage		V_{SET2} = 2V, I_{HYST2} = -0.2mA	All grades: V+ = 2V		-0.25	-0.80	V
		V_{SET2} = 2V, I_{HYST2} = -0.5mA	All grades: V+ = 5V		-0.43	-1.00	
			ICL7665: V+ = 15V		-0.35	-0.80	
			ICL7665A: V+ = 15V		-0.35	-1.00	
			ICL7665B: V+ = 9V		-0.35	-1.00	
V_{SET} Input Leakage Current	I_{SET}	GND ≤ V_{SET} ≤ V+			±0.01	±10	nA
V_{SET} Input Change for Complete Output Change	ΔV_{SET}	R_{OUT} = 4.7kΩ, R_{HYST} = 20kΩ, V_{OUT}LO = 1% V+, V_{OUT}HI = 99% V+			0.1		mV
Difference in Trip Voltage	V_{SET1}– V_{SET2}	R_{OUT}, R_{HYST} = 1MΩ			±5	±50	mV
Output/Hysteresis Difference		R_{OUT}, R_{HYST} = 1MΩ			±0.1		mV

AC OPERATING CHARACTERISTICS

(V+ = 5V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Delay Time, Input Going High	t_{SO1d}	V_{SET} switched from 1.0V to 1.6V, R_{OUT} = 4.7kΩ, C_L = 12pF, R_{HYST} = 20kΩ		85		µs
	t_{SH1d}			90		
	t_{SO2d}			55		
	t_{SH2d}			55		
Output Delay Time, Input Going Low	$t_{\overline{SO}1d}$	V_{SET} switched from 1.6V to 1.0V, R_{OUT} = 4.7kΩ, C_L = 12pF, R_{HYST} = 20kΩ		75		µs
	$t_{\overline{SH}1d}$			80		
	$t_{\overline{SO}2d}$			60		
	$t_{\overline{SH}2d}$			60		
Output Rise Times	t_{O1r}	V_{SET} switched between 1.0V and 1.6V, R_{OUT} = 4.7kΩ, C_L = 12pF, R_{HYST} = 20kΩ		0.6		µs
	t_{O2r}			0.8		
	t_{H1r}			7.5		
	t_{H2r}			0.7		
Output Fall Times	t_{O1f}	V_{SET} switched between 1.0V and 1.6V, R_{OUT} = 4.7kΩ, C_L = 12pF, R_{HYST} = 20kΩ		0.6		µs
	t_{O2f}			0.7		
	t_{H1f}			4.0		
	t_{H2f}			1.8		

Switching Waveforms



Microprocessor Voltage Monitor with Dual Over/Undervoltage Detection

SCR Latchup

Like all junction-isolated CMOS circuits, the ICL7665 has an inherent four-layer or SCR structure that can be triggered into destructive latchup under certain conditions. Avoid destructive latchup by following these precautions:

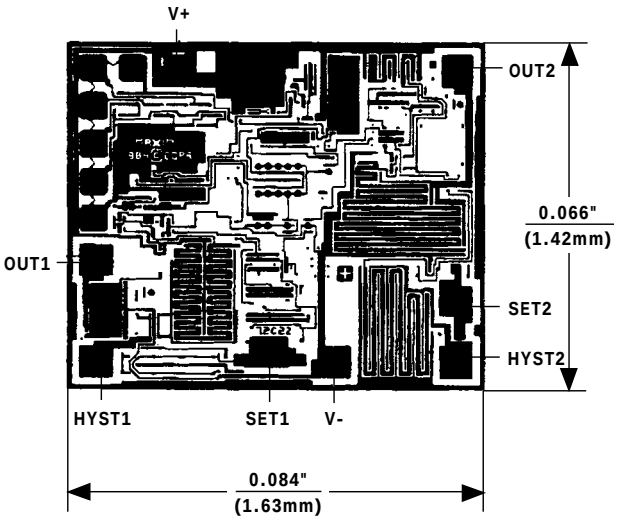
1) If either V_{SET} terminal can be driven to a voltage greater than V+ or less than ground, limit the input current to 500µA maximum. Usually, an input voltage divider resistance can be chosen to ensure the input current remains below 500µA, even when the input voltage is applied before the ICL7665 V+ supply is connected.
2) Limit the rate-of-rise of V+ by using a bypass capacitor near the ICL7665. Rate-of-rise SCRs rarely occur unless: a) the battery has a low impedance—as is the case with NiCd and lead acid batteries; b) the battery is connected directly to the ICL7665 or is switched on via a mechanical switch with low resistance; or c) there is little or no input filter capacitance near the ICL7665. In line-powered systems, the rate-of-rise is usually limited by other factors and will not cause a rate-of-rise SCR action under normal circumstances.
3) Limit the maximum supply voltage (including transient spikes) to 18V. Likewise, limit the maximum voltage on OUT1 and OUT2 to +18V and the maximum voltage on HYST1 and HYST2 to 18V below V+.

Ordering Information (continued)

PART	TEMP. RANGE	PIN-PACKAGE
ICL7665CTV	0°C to +70°C	8 TO-99
ICL7665ACTV	0°C to +70°C	8 TO-99
ICL7665BCTV	0°C to +70°C	8 TO-99
ICL7665AC/D	0°C to +70°C	Dice*
ICL7665IPA	-20°C to +85°C	8 Plastic DIP
ICL7665IJA	-20°C to +85°C	8 CERDIP
ICL7665EPA	-40°C to +85°C	8 Plastic DIP
ICL7665AEPA	-40°C to +85°C	8 Plastic DIP
ICL7665ESA	-40°C to +85°C	8 SO
ICL7665AESA	-40°C to +85°C	8 SO

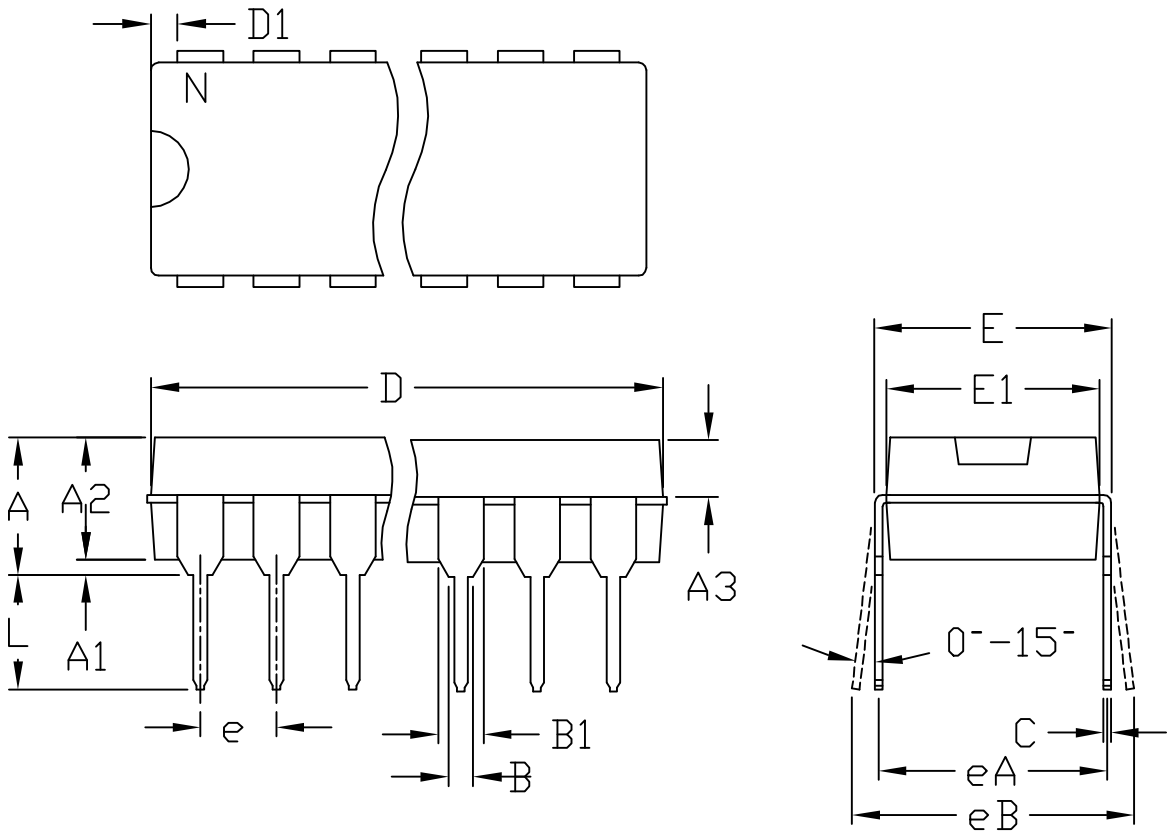
**Contact factory for dice specifications.*

Chip Topography



TRANSISTOR COUNT: 38

SUBSTRATE CONNECTED TO V+.



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.180	---	4.572
A1	0.015	---	0.38	---
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.015	0.022	0.381	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.014	0.2	0.355
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100 BSC.		2.54 BSC.	
eA	0.300 BSC.		7.62 BSC.	
eB	0.400 BSC.		10.16 BSC.	
L	0.115	0.150	2.921	3.81

	INCHES		MILLIMETERS			
	MIN	MAX	MIN	MAX	N	MS001
D	0.348	0.390	8.84	9.91	8	AB
D	0.735	0.765	18.67	19.43	14	AC
D	0.745	0.765	18.92	19.43	16	AA
D	0.885	0.915	22.48	23.24	18	AD
D	1.015	1.045	25.78	26.54	20	AE
D	1.14	1.265	28.96	32.13	24	AF
D	1.360	1.380	34.54	35.05	28	*5

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC MS001-XX AS SHOWN IN ABOVE TABLE
5. SIMILIAR TO JEDEC MO-058AB
6. N = NUMBER OF PINS

MAXIM
120 SAN GABRIEL DR SUNNYVALE CA 94086 FAX (408) 737 7194

PACKAGE FAMILY OUTLINE: PDIP .300"
TITLE

1/1

21-0043 D
DOCUMENT CONTROL NUMBER REV