iC-HE
TRIPLE DIFFERENTIAL LINE DRIVER

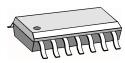
FEATURES

- Complementary short-circuit-proof push-pull driver stages for RS422 and 24 V applications up to 2 MHz
- SO14N package pin-compatible to ET9600
- Integrated line adaptation for high signal quality at 24 V
- Moderate slew rate reduces EMI
- High driving capability of typically 200 mA at 24 V
- Output saturation of just 0.3 V at 40 mAdc
- Tristate function with excessive temperature
- TTL-/CMOS-compatible Schmitt trigger inputs, voltage-proof to 40 V
- 4.5 to 35 V single supply operation with low static power dissipation
- Operating temperature from -25 to 125 °C (-40 °C is optional)
- 50 mA LED driver with ISET input for current control

APPLICATIONS

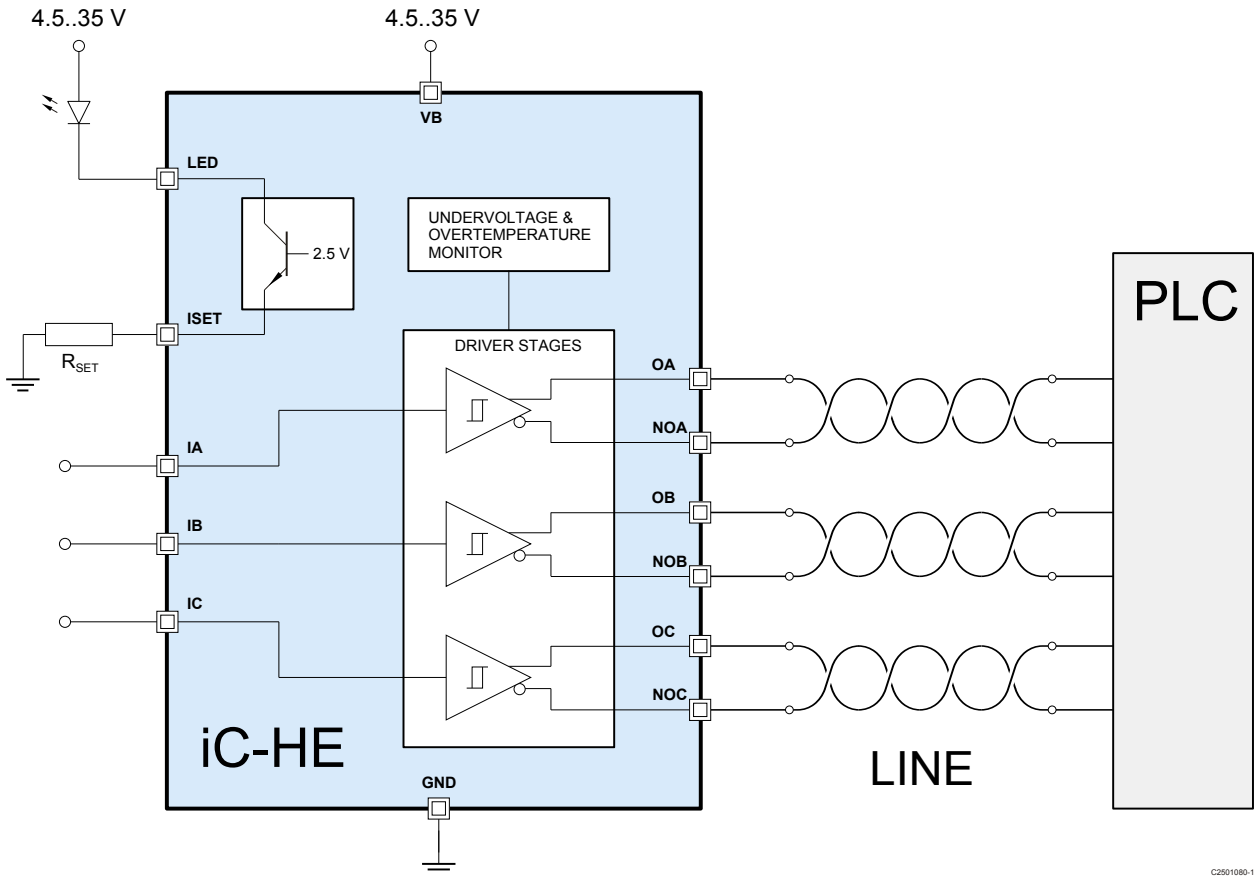
- Line drivers for 24 V control engineering
- Linear scales and encoders
- Sensor systems

PACKAGES



SO14N

BLOCK DIAGRAM



DESCRIPTION

The iC-HE is a three channel line driver with complementary outputs optimized for line impedances in the range of 75 Ω.

The push-pull output stages can deliver at least 200 mA from 24 V supply and are short-circuit-proof and current-limited, shutting down with excessive temperature or undervoltage conditon.

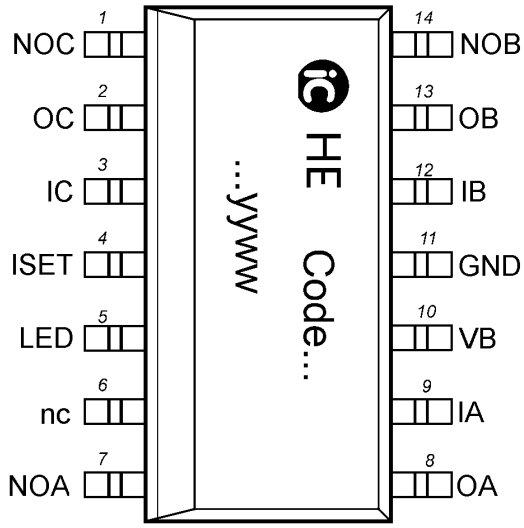
All inputs are compatible with CMOS and TTL levels.

The emitter and collector outputs of an on-chip NPN transitor is available for driving an external light emitting diode. The base of the transistor is connected to an internal reference voltage of 2.5 V. Collector current at pin LED can be controlled by the value of the resistor connected between ISET and ground.

The device is protected against ESD.

PACKAGING INFORMATION

PIN CONFIGURATION SO14N



PIN FUNCTIONS

No.	Name	Function
1	NOC	Inverted Output Driver C
2	OC	Output Driver C
3	IC	Input Driver C
4	ISET	LED Current Setting
5	LED	LED Current Output
6	n.c.	
7	NOA	Inverted Output Driver A
8	OA	Output Driver A
9	IA	Input Driver A
10	VB	Supply Voltage
11	GND	Ground
12	IB	Input Driver B
13	OB	Output Driver B
14	NOB	Inverted Output Driver B

ABSOLUTE MAXIMUM RATINGS

Beyond these values damage may occur; device operation is not guaranteed. Absolute Maximum Ratings are no Operating Conditions. Integrated circuits with system interfaces, e.g. via cable accessible pins (I/O pins, line drivers) are per principle endangered by injected interferences, which may compromise the function or durability. The robustness of the devices has to be verified by the user during system development with regards to applying standards and ensured where necessary by additional protective circuitry. By the manufacturer suggested protective circuitry is for information only and given without responsibility and has to be verified within the actual system with respect to actual interferences.

Item No.	Symbol	Parameter	Conditions	Min.	Max.	Unit
G001	VB	Supply Voltage		0	40	V
G002	Vin()	Voltage at Inputs IA, IB, IC		0	VB	V
G003	V()	Voltage at Outputs OA..OC, NOA..NOC		0	VB	V
G004	I()	Current in Outputs OA..OC, NOA..NOC		-500	500	mA
G005	V(LED)	Voltage at LED		0	40	V
G006	I(LED)	Current in LED		-300	300	mA
G007	V(ISET)	Voltage at ISET		0	6	V
G008	I(ISET)	Current in ISET		-300	15	mA
G009	Vd()	ESD Susceptibility	HBM, 100 pF discharged through 1.5 kΩ		2	kV
G010	Tj	Junction Temperature		-40	150	°C
G011	Ts	Storage Temperature		-40	150	°C

THERMAL DATA

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T01	Ta	Operating Ambient Temperature (extended range to -40°C on request)		-25		125	°C
T02	Rthja	Thermal Resistance SO14N	surface mounted, no special heat sink		160		K/W

All voltages are referenced to ground unless otherwise stated.
All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

ELECTRICAL CHARACTERISTICS

Operating Conditions: VB = 4.5...35 V, Tj = -40...125 °C, unless otherwise noted

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Total Device							
001	VB	Permissible Supply Voltage		4.5		35	V
002	V(LED)	Permissible Voltage at LED	no clamp diode to VB	4.5		35	V
003	I(VB)	Supply Current in VCC	no loads on outputs, ISET open		2.6	4	mA
004	Vc()lo	Clamp Voltage low at Ix inputs	I() = -1 mA	-1.2		-0.4	V
005	Vc()hi	Clamp Voltage high at Ix inputs	I() = 1 mA	VB + 0.4		VB + 1.2	V
006	Vc()lo	Clamp Voltage lo at OA, OB, OC, NOA, NOB, NOC	VB = 0 V, I() = -10 mA	-1.2		-0.4	V
007	Vc()hi	Clamp Voltage hi at OA, OB, OC, NOA, NOB, NOC	VB = 0 V, I() = 10 mA	VB + 0.4		VB + 1.2	V
008	Vc(LED)lo	Clamp Voltage low at LED	I() = -10 mA	-1.2		-0.4	V
009	Vc(LED)hi	Clamp Voltage high at LED	I() = 10 mA	41		58	V
010	Vc(ISET)lo	Clamp Voltage low at ISET	VB = 0 V, I() = -10 mA	-1.2		-0.4	V
011	Vc(ISET)hi	Clamp Voltage high at ISET	VB = 0 V	0.8		2.4	V
Driver Outputs Ox, NOx (x = A...C)							
101	Vs()lo	Saturation voltage low	I(A) = 40 mA		0.2	0.5	V
102	Vs()hi	Saturation voltage high	I(A) = -40 mA		0.3	0.7	V
103	Iout()hi	Output current lo	VB = 30 V, V(Ox, NOx) = 3 V	40	60	90	mA
104	Iout()hi	Output current hi	VB = 30 V, V(Ox, NOx) = VB – 3 V	-90	-60	-40	mA
105	Isc()lo	Short-Circuit Current lo	VB = 30 V, V(Ox, NOx) = VB		200	500	mA
106	Isc()hi	Short-Circuit Current hi	V(Ox, NOx) = 0 V	-500	-200		mA
107	Rout()	Output Resistance	VB = 10...30 V, V(Ox) = 0.5 * VB	50	75	110	Ω
108	SR()lo, hi	Slew-Rate lo, hi	VB = 24 V, CL = 100 pF		400		V/µs
109	tp()lo, hi	Delay Time lo,hi	not tested, guaranteed by design		75	200	ns
110	dtp()	Delay Time Difference	not tested, guaranteed by design	-35		35	ns
111	Ilk()	Output Leakage Current	at overtemperature shutdown	-100		100	uA
Driver Inputs Ix (x=A...C)							
201	Vt()lo	Threshold Voltage lo		0.8			V
202	Vt()hi	Threshold Voltage hi				2.4	V
203	Vt()hys	Input Hysteresis		0.1	0.2		V
204	I()	Input Leakage Current in Ix	0 V < V(Ix) < 5 V	-5		5	µA
Undervoltage Detection							
501	Voff	Undervoltage Threshold lo		2	3.4		V
502	Von	Undervoltage Threshold hi			3.5	4.1	V
503	Vhys	Hysteresis		35	100		mV
504	tp()shut	Reset Delay Time			20		us
Thermal Shutdown							
601	Toff	Shutdown Temperature		130	150	170	°C
602	ΔToff	Hysteresis			8		°C
LED driver							
701	TC(ISET)	Temp.- Koeffizient at ISET	I(ISET) = 10 mA		2.0		mV/°K
702	V(ISET)	Voltage at ISET	Tj = 27 °C ; I(ISET) = 1 mA	1.7	1.93	2.2	V
703	V(ISET)	Voltage at LED	Tj = 27 °C ; I(ISET) = 10 mA	1.5	1.82	2.1	V
704	V(ISET)	Voltage at ISET	Tj = 27 °C ; I(ISET) = 50 mA	1.3	1.64	2	V
705	CR	Current Ratio I(LED)/I(ISET)	I(ISET) = 1 .. 50 mA	0.97		1	
706	Isc(LED)	Short-Circuit Current in LED	V(ISET)= 0 V	65	125	250	mA
707	Vs(LED)	Saturation Voltage NPN	Vs(LED) = V(LED) – V(ISET); I(LED) = 1 mA		0.15	0.4	V
708	Vs(LED)	Saturation Voltage NPN	Vs(LED) = V(LED) – V(ISET); I(LED) = 50 mA		0.55	1.2	V
709	Ilk(LED)	Leakage Current in LED	ISET open, V(LED) = 35 V			100	µA

ELECTRICAL CHARACTERISTICS

Operating Conditions: VB = 4.5...35 V, Tj = -40...125 °C, unless otherwise noted

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
710	Ilk(LED)	Leakage Current in LED	over temperature condition, V(LED) = 35 V			200	µA

ELECTRICAL CHARACTERISTICS: Diagrams

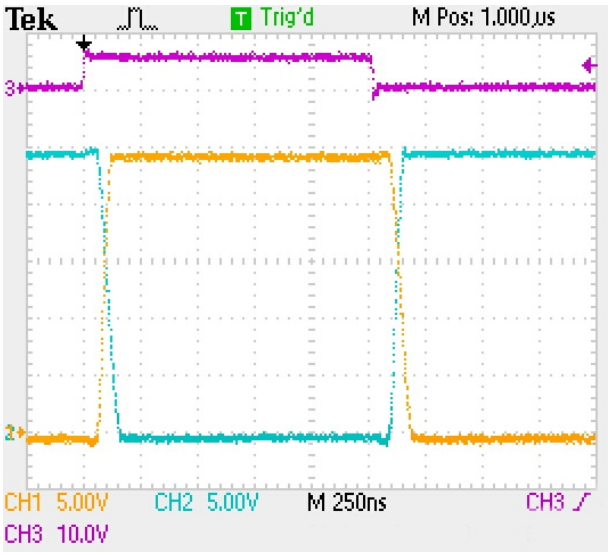


Figure 1: Example of moderate slew rate with unloadad Ox and NOx outputs (VB = 24 V)

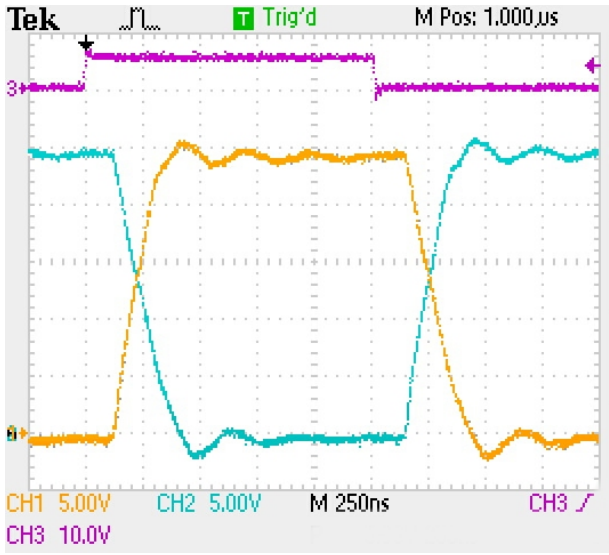


Figure 2: Example of typical line end signal without termination (VB = 24 V, length of cable 10 m)

DESIGN REVIEW: Notes on Chip Functions

iC-HE X		
No.	Function, Parameter/Code	Description and Application Hints
		No further notes at time of printing.

Table 4: Notes on chip functions regarding iC-HE chip revision X

REVISION HISTORY

Rel.	Rel. Date*	Chapter	Modification	Page
A1	2009-11-30	ALL	First Release	all pages

Rel.	Rel. Date*	Chapter	Modification	Page
A2	2020-07-29	All	Label "preliminary" removed	all pages
		BLOCK DIAGRAM	Color of block diagram changed to blue	2
		DESIGN REVIEW: Notes on Chip Functions	Section DESIGN REVIEW introduced for completeness	6
		Revision History	introduced and updated	6
		Disclamer	current version at time of printing	6
		ORDERING INFORMATION	order handling team contact information added	last page

* Release Date format: *YYYY-MM-DD*

ORDERING INFORMATION

Type	Package	Order Designation
iC-HE	SO14N	iC-HE SO14N

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