iC-WK, iC-WKL

2.4 V CW LASER DIODE DRIVER

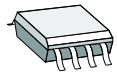
FEATURES

- CW operation up to 90 mA from 2.4 to 6 V supply voltage
- Rapid soft start after power-on typical within 70 µs
- Simple power adjustment via the external resistor
- Control loop accuracy better than 1% with changes in temperature, supply voltage and load current
- Integrated reverse polarity protection for the iC and laser diode
- Strong suppression of transients with very small external capacitors; integrated flyback path
- Permanent shutdown with excessive temperature and overcurrent (i.e. if the laser diode is damaged or the feedback current path fails)
- Two feedback inputs permit all current LD types to be used (N/P/M configurations)
- Modulation via the feedback inputs is possible
- Wide monitor current range from 10 µA to 2.5 mA
- **iC-WK** with additional spike detection at monitor input MDA

APPLICATIONS

- Battery-powered LD modules
- LD Pointers
- Laser levels
- Bar-code readers

PACKAGES

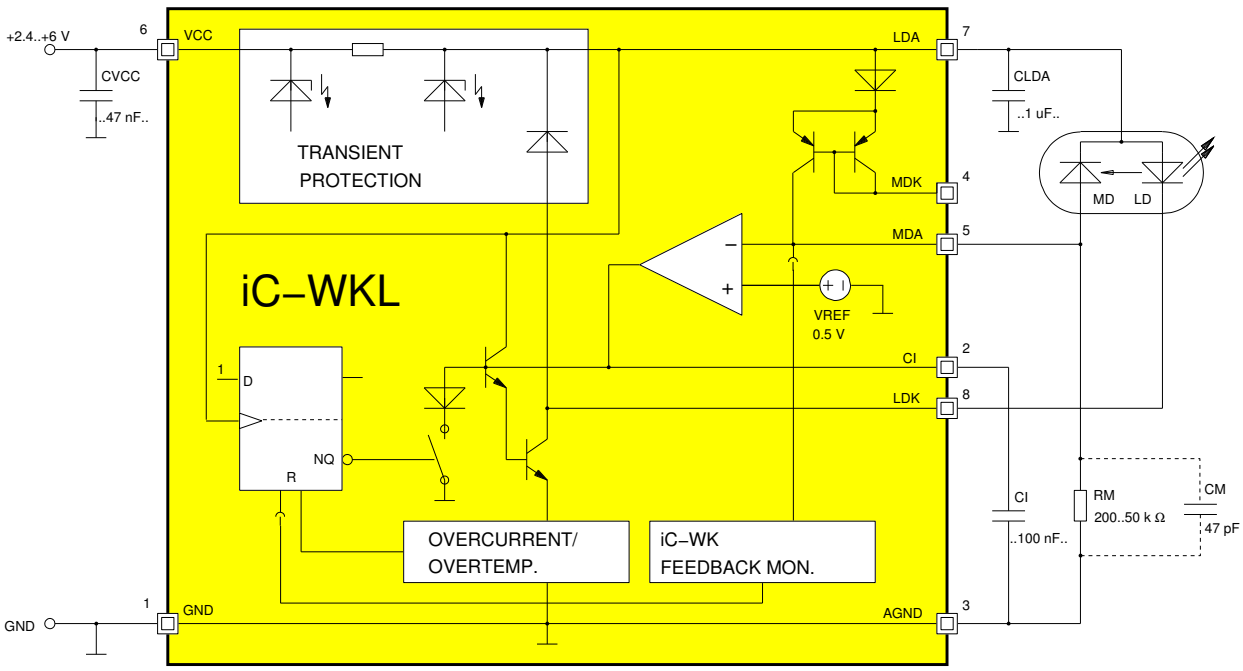


SO8

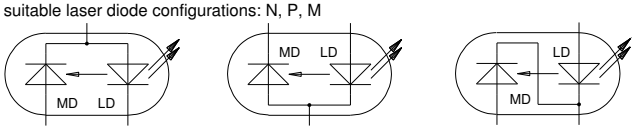


MSOP8

BLOCK DIAGRAM



suitable laser diode configurations: N, P, M



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DESCRIPTION

The iC-WK/L device is a driver for laser diodes in continuous wave operation which requires only four external components. The wide power supply range of 2.4 to 6 V and the integrated reverse battery protection allow for battery operation with a minimum of two cells. A reversed battery connection destroys neither the iC nor the laser diode.

The iC includes integrated circuitry protecting against destruction by ESD, excessive temperature and overcurrent and a soft start which regulates the power and protects the laser diode when the power supply is switched on. The iC also filters the laser diode power supply for transients.

The power supply is regulated and adapted to the laser diode used by an external resistor at MDA. The monitor current acts as a reference and is regulated independent of the influence of temperature and supply voltage (range: 10 µA to 2.5 mA). The capacitor at CI determines the control time constants and start-up time.

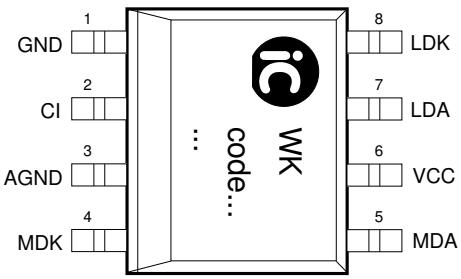
A second monitor input, pin MDK, allows the driver to be used for other types of laser diode configuration; alternatively, it can be used as an analogue modulation input (DC to a few kHz).

In the event of failure, such as overcurrent in the laser path with a lack of feedback, for example, a quick power lockout is activated. The shutdown continues until power is reapplied, permitting a restart. The strain on power packs and batteries is relieved and the laser class is retained even in the event of a disturbance.

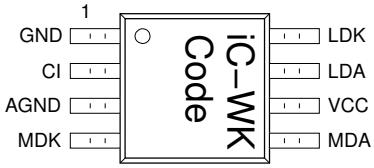
iC-WK offers additional protection by means of spike detection at pin MDA. Should spikes or oscillation occur at pin MDA the power lockout is activated.

PACKAGES SO8, MSOP8 to JEDEC

PIN CONFIGURATION SO8
(top view)



PIN CONFIGURATION MSOP8
(top view)



PIN FUNCTIONS

No.	Name	Function
1	GND	Ground
2	CI	Capacitance for Power Control
3	AGND	Reference Ground for CI, RM
4	MDK	Monitor Input 2 (MD Cathode, Modulation)
5	MDA	APC Setup, Monitor Input 1 (MD Anode)
6	VCC	+2.4 to +6 V Supply Voltage
7	LDA	Laser Supply (LD Anode)
8	LDK	Driver Output (LD Cathode)

Do not short-circuit pins AGND and GND, for this may deteriorate the precision of the regulator and interfere with the soft-start!

ABSOLUTE MAXIMUM RATINGS

No Destruction, correct function not guaranteed.

Item No.	Symbol	Parameter	Conditions	Fig.	Min.	Max.	Unit
G001	VCC	Voltage at VCC			-6	6.5	V
G002	I(VCC)	Current in VCC			-10	95	mA
G003	I(CI)	Current in CI			-10	10	mA
G004	I(LDA)	Current in LDA			-95	10	mA
G005	I(LDK)	Current in LDK			-10	95	mA
G006	I(MDA)	Current in MDA			-10	10	mA
G007	I(MDK)	Current in MDK			-10	10	mA
G008	I(AGND)	Current in AGND			-10	10	mA
G009	I(GND)	Current in GND			-95	10	mA
G010	Vd()	ESD Susceptibility at all pins	MIL-STD-833, method 3015, HBM 100 pF unloaded over 1.5 kΩ			2	kV
G011	Tj	Operting Junction Temperature			-40	150	°C
G012	Ts	Storage Temperature Range			-40	150	°C

THERMAL DATA

Operating Conditions: VCC = 2.4...6 V

Item No.	Symbol	Parameter	Conditions	Fig.	Min.	Typ.	Max.	Unit
T01	Ta	Operating Ambient Temperature Range			-40		85	°C
T02	Rthja	Thermal Resistance Chip/Ambient	SMD assembly, no additional cooling areas				140	K/W

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

ELECTRICAL CHARACTERISTICS

Operating Conditions: VCC = 2.4...6 V, RM = 200 Ω...50 kΩ, Tj = -40...125 °C unless otherwise noted

Item No.	Symbol	Parameter	Conditions	Tj °C	Fig.	Min.	Typ.	Max.	Unit
Total Device									
001	VCC	Permissible Supply Voltage				2.4		6	V
002	I(LDK)m	Permissible Laser Drive Current (closed control loop)	Tj = -40...125 °C Tj = -40...80 °C			5 5		70 90	mA mA
003	Idc(VCC)	Supply Current without load path	closed control loop, I(MDK) = 0				2.4	5.5	mA
004	Ioff(VCC)	Supply Current on Reset					2.4	5	mA
005	Ir(VCC)	Reverse Supply Current	RM = 50 kΩ, VCC = -6 V			-6	-3		mA
006	ton()	Turn-on Delay	VCC: 0 → 5 V to 95 % I(LDK), I(LDK) = I(LDK)m; CI = 47 nF CI = 100 nF					 70 150	 µs µs
007	Vc()hi	Clamp Voltage hi at VCC, LDA, MDK	I() = 10 mA, other pins open			6		9	V
008	Vc(LDK)hi	Clamp Voltage hi at LDK	V() < VCC + 1 V; I() = 10 mA, other pins open			6		9	V
009	Vc(MDA)hi	Clamp Voltage hi at MDA	I() = 10 mA, other pins open **iC-WKL** **iC-WK**			 6 1.1		 9 4	 V V
010	Vc()hi	Clamp Voltage hi at CI	I() = 10 mA, other pins open			1.1		4	V
011	Vc()lo	Clamp Voltage lo at VCC, LDA, MDK, MDA, CI	I() = -10 mA, other pins open			-9			V
Reference and Monitor Inputs MDA, MDK, AGND									
101	V(MDA)	Reference Voltage at MDA	closed control loop, V(LDK) > Vs(LDK)			480	500	520	mV
102	dV(MDA)	Reference Voltage Temperature Drift at MDA	see 101;					120	µV/°C
103	Ierr(MDA)	Input Current in MDA	closed control loop, I(MDK) = 0			-300		300	nA
104	dI(MDA)	Input Current Temperature Drift in MDA	see 103;			-2		2	nA/°C
105	APCerr	Control Error	RM = 10 kΩ, Tj = 0...80 °C RM = 10 kΩ, Tj = -40...125 °C					0.3 1	% %
106	dI(MD)	Supply Voltage Suppression of monitor current	V(VCC): 2.4 → 6 V, I(LDK) = 70 mA			-1		1	%
107	Rgnd()	Resistor AGND-GND						3	Ω
108	Vf(MDK)	Voltage at MDK	Vf() = V(LDA) – V(MDK); I(MDK) = 1 µA...1 mA			0.46		2.1	V
109	CR()	Current Ratio I(MDA)/I(MDK)	I(MDK) = 10...500 µA I(MDK) = 500 µA...2.5 mA			0.975 0.95		1.025 1.05	
110	TC()	Current Ratio Temperature Coefficient I(MDA) / I(MDK)	I(MDK) = 10...500 µA I(MDK) = 500 µA...2.5 mA			-0.005 -0.025		0.005 0.025	%/°C %/°C
Laser Drive LDA, LDK									
201	Vs(LDK)	Saturation Voltage at LDK	I(LDK) = 40 mA I(LDK) = 70 mA, Tj = -40...125 °C I(LDK) = 90 mA, Tj = -40...80 °C					300 400 400	mV mV mV
202	dI(MD)	Load Balancing Error	I(LD) = 20 mA, I(LDK): 20 mA → 70 mA			-1		1	%
203	It(LDK)	Overcurrent Threshold in LDK	Tj = -40...125 °C Tj = -40...80 °C			70 90	130	300 300	mA mA
204	toff()	Overcurrent Reset Delay	lack of feedback: I(RM) = 0 to I(LDK) = It(LDK); I(LDK) = 20 mA, CI = 47 nF I(LDK) = 20 mA, CI = 100 nF I(LDK) = 60 mA, CI = 47 nF I(LDK) = 60 mA, CI = 100 nF					 85 170 60 130	 µs µs µs µs
205	Vf()	Diode Forward Voltage LDK-LDA	I(LDK) < 70 mA					1.1	V
206	Rvcc()	Transient Protection Resistor	VCC vs. LDA					4	Ω

ELECTRICAL CHARACTERISTICS

Operating Conditions: VCC = 2.4...6 V, RM = 200 Ω...50 kΩ, Tj = -40...125 °C unless otherwise noted

Item No.	Symbol	Parameter	Conditions	Tj °C	Fig.	Min.	Typ.	Max.	Unit
207	Vt(MDA)	Shutdown Threshold at MDA	**iC-WK only**			0.56		2	V
Control Release Flip-Flop									
401	VCCen	Set Threshold for Enable Flip-Flop				0.6		1.9	V
402	Toff	Overtemperature Shutdown				125		150	°C

SAFETY INSTRUCTIONS

Laser light can damage the human eye and the eyes of animals! Do not look at any laser light directly or through any optical lens. When handling a laser diode, do not look directly at the light generated by it. Wear appropriate safety glasses to prevent light from entering the eye even by reflection.



TURN-ON/OFF BEHAVIOUR

Turn-on behaviour

After switching on the supply voltage the output stage remains disabled until the internal enabling flip-flop is set by a sufficiently high voltage at LDA.

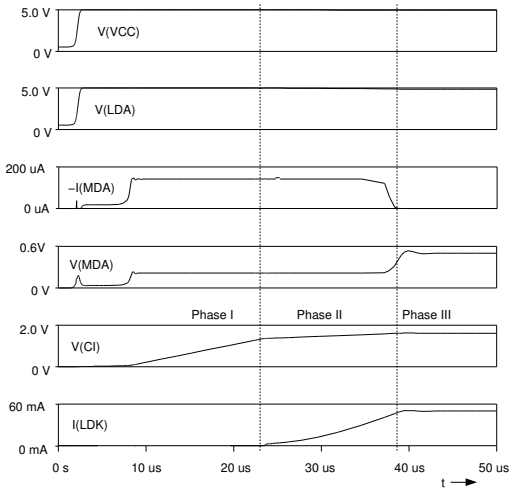


Figure 1: Turn-on behaviour

A quick soft start occurs during phase I; the control capacitor CI is loaded at an accelerated rate until the output stage supplies current at LDK. An open-circuit voltage at pin MDA is used to verify the external resistance.

Phase II, the initialisation process, begins when current starts to flow at LDK. This phase ends when the laser reaches its threshold current and the monitor current produced raises the potential at resistor RM.

The transition to CW operation (phase III) is gradual and primarily influenced by the CI and RM components. CI is properly dimensioned when the voltage overshot at MDA is at a minimum.

Turn-off behaviour

iC-WK/L functions without a fixed undervoltage lockout, thus the laser diode forward voltage is the prime factor determining the lowest possible supply voltage.

If the voltage drops below this, the output stage is forcibly saturated and the laser current falls. In this instance iC-WK/L simultaneously discharges control capacitor CI so that no excessive laser diode currents occur when the supply voltage rises again.

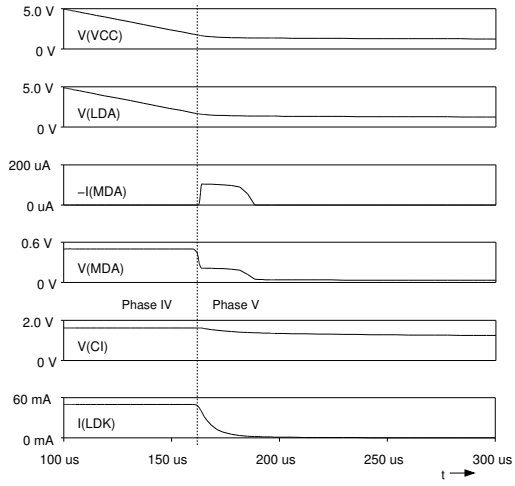


Figure 2: Turn-off behaviour

Disruptions in operation

The power control is shut down with excessive driver temperature or when the laser current reaches the overcurrent shutdown threshold, for example when the feedback is interrupted. If the monitor diode or the preset resistor RM fail, the device is shutdown in less than 250 µs, provided that the supply voltage applied is high enough.

When modulating or switching the laser current via pin MDK (see Application Notes), excessive Voltage occurring at pin MDA also causes a shut down (**iC-WK only**).

APPLICATION NOTES

Setting the output power

The output power is simply set by RM = V(MDA) / I(MD); with V(MDA) = Item-No. 101 and I(MD) = monitor current at the desired operating point. RM should be combined from fixed resistor (max. output power) and a trimmer (calibration).

Further application notes on iC-WK/L and the data sheets of the evaluation modules and the demo board are available as separate documents.

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ORDERING INFORMATION

Type	Package	Order Designation
iC-WK	SO8	iC-WK SO8
	MSOP8	iC-WK MSOP8
iC-WKL	SO8	iC-WKL SO8
	MSOP8	iC-WKL MSOP8
WK Module for P-/M-Type Laser		iC-WK iCSY WK1D
WKL Module for P-/M-Type Laser		iC-WKL iCSY WK1D
WK Module for N-Type Laser		iC-WK iCSY WK2D
WKL Module for N-Type Laser		iC-WKL iCSY WK2D
WK Evaluation Board		iC-WK EVAL WK4D
WKL Evaluation Board		iC-WKL EVAL WK4D

For information about prices, terms of delivery, other packaging options etc. please contact:

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