IC for AC/DC Converter with built–in Power DMOS Transistor with Operating Frequency 132 ± 8 kHz

IK3466

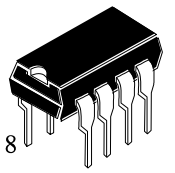
Functional equivalent of TNY266 (Power Integrations)

Description

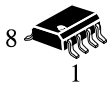
IK3466 is IC for AC/DC converter with build–in power switch with operating frequency 132 ± 8 kHz realized on the base of high-voltage BiCDMOS process.

IC performs driving of power built in MOSFET switch, quantity of energy transferred to load is regulated by means of MOSFET on-time. So output voltage practically doesn't depend from load.

The IC is purposed for adapter battery chargers of the mobile phones, reserve power supply of PC, TV-sets, AC-adapters, electrical equipment control units, Integrated Services Digital Network (ISDN) or Digital Subscriber Line (DSL) network termination.



N SUFFIX
PLASTIC



D SUFFIX
SOIC

ORDERING INFORMATION

IK3466N Plastic
IK3466D SOIC

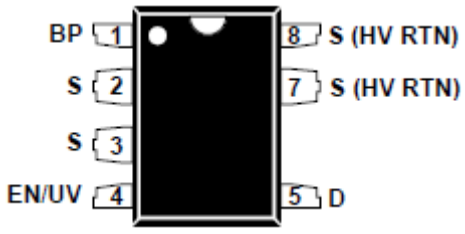
ORDERING INFORMATION

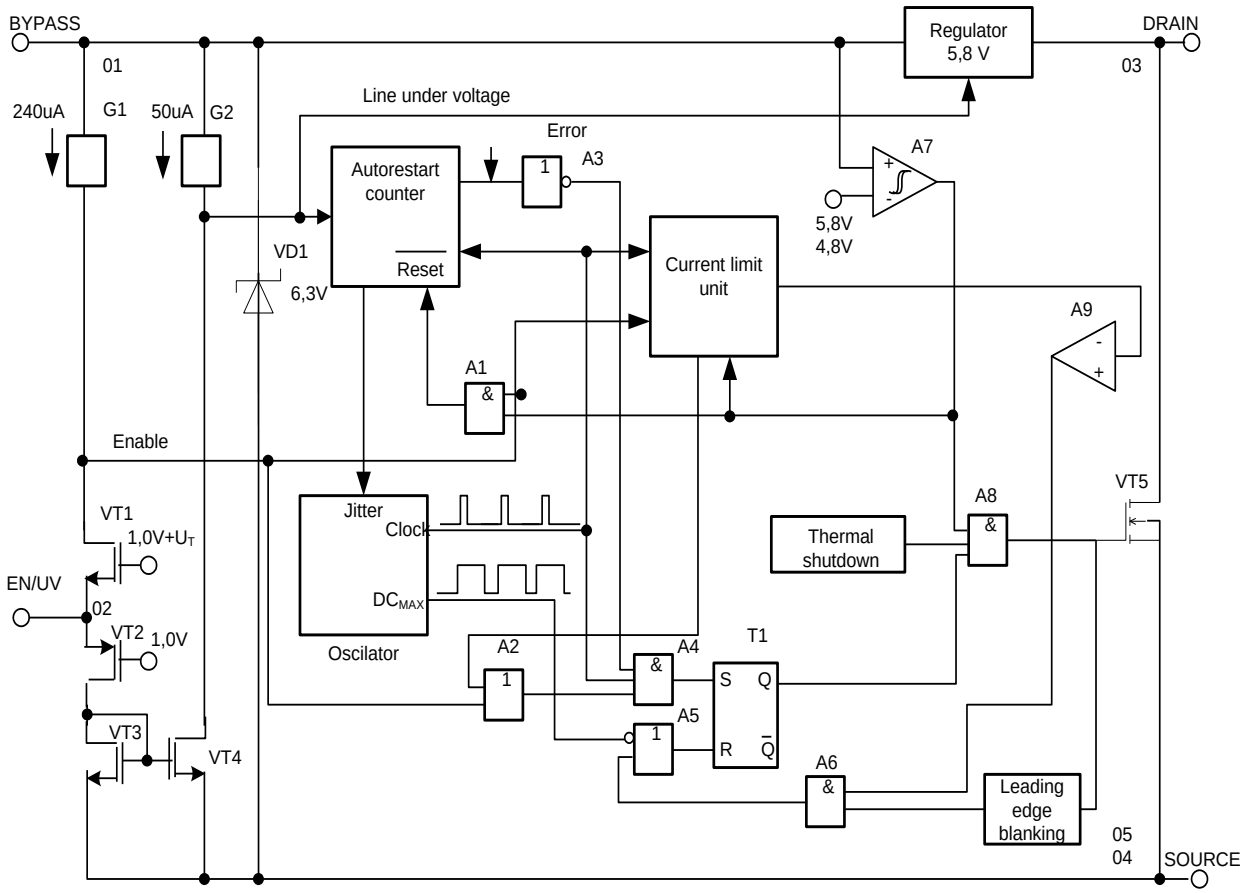
Device	Operating Temperature Range	Package	Packing
IK3466N	T_A = -40… + 125 °C	DIP-8	Tube
IK3466D		SOP-8	Tube
IK3466DT		SOP-8	Tape& Reel

Features

- Programmable line under-voltage detect circuit prevents power on/off glitches and minimizes quantity of external components
- 132 kHz operation frequency
- High output voltage stability
- Simple ON/OFF control, no loop compensation needed
- No load consumption < 50 mW with bias winding and < 250 mW without bias winding at 265 V (AC) input
- High input (supply) voltage makes IC ideal for charger applications
- High bandwidth provides fast turn on with no overshoot
- Built-in current limit and thermal protection circuits provide high safety
- Built-in automatic restart circuit provides short circuit and open loop protection
- Undervoltage detection function

Pin Configuration





A1 – A6, A8 – logic elements;
A7 –dual-threshold comparator;
A9 – current limit comparator;
G1, G2 – DC current source;
T1 – trigger;
VD1 – Zener diode;
VT1 – VT4 - MOS transistors
VT5 – high voltage output n-channel DMOS transistor

Fig. 1 – Electric block diagram

Table 2 - Absolute Maximum Ratings

Symbol	Parameter	Target		Unit
		Min	Max	
V_D	DRAIN lead supply voltage	-0,3	700	V
I_{DMAX}	Peak current, DRAIN lead,	-	560	mA
$V_{EN/UV}$	EN/UV lead voltage	-0,3	9	V
$I_{EN/UV}$	EN/UV lead current	-	100	mA
V_{BP}	BYPASS lead voltage	-0,3	9	V
T_{stg}	Storage temperature	-60	150	^oC

* 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 under “recommended operating conditions” is not implied.
Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Table 3 – Recommended Operation Mode

Symbol	Parameter	Norm		Unit
		Min	Max	
V_{DS}	DRAIN lead supply voltage	50	700	V
I_{DS}	Peak current, DRAIN lead,	-	375	mA
V_{BP}	BYPASS lead voltage	-	6,15	V
T_J	Junction temperature	-40*	125	^oC

_____
* Ambient temperature

Table 3 – Electric Parameters IK3466 .
(T_J - 40* … +125^{o}C, SOURCE = 0V , unless otherwise specified)

Parameter	Symbol	Measurement mode	Target		Unit
			Min.	Max.	
Control function					
Operating frequency	f_{OSC}	T_J = 25^{o}C	124	140	kHz
Maximum duty cycle	DC_{MAX}	S1 open	62	68	%
EN/UV pin turnoff threshold current	I_{DIS}		-300	-170	µA
EN/UV pin voltage	V_{EN}	$I_{EN/UV}$ = -125 uA	0,4	1,5	V
		$I_{EN/UV}$ = 25 uA	1,3	2,7	
DRAIN supply current	I_{S1}	$V_{EN/UV}$=0 V		500	µA
	I_{S2}	EN/UV open (MOSFET Switching) Notes 1, 2		320	

Table 3 continued

Parameter	Symbol	Mode of measurements	Target Min.	Target Max.	Unit
BYPASS pin charge current	I_{CH1}	V_{BP} = 0 V, T_J = 25 °C Note 3	-7,5	-2,5	mA
	I_{CH2}	V_{BP} = 4 V, T_J = 25 °C Note 3	-4,5	-1,5	
BYPASS pin voltage	V_{BP}	Note 3	5,6	6,15	V
BYPASS pin voltage hysteresis	V_{BPH}	-	0,8	1,2	V
EN/UV pin line under-voltage threshold current	I_{LUV}	T_J = 25°C	44	54	µA
Protection circuit					
Current limit	I_{LIMIT}	di/dt = 70 mA/µs	325	375	mA
Initial current limit	I_{INIT}	T_J = 25°C	0.65 x $I_{LIMIT(MIN)}$		mA
Leading edge blanking time	t_{LEB}	T_J = 25°C Note 4	170		ns
Thermal Shutdown Temperature	t_{SD}	-	125	150	°C
Output parameters					
ON-state switch resistance	$R_{DS(ON)}$	I_D= 35mA, T_J = 25°C		16	Ω
		I_D= 35mA, T_J = 100°C		24	
Off-state switch drain current	I_{DSS}	V_{BP} = 6.2 V, $V_{EN/UV}$ = 0 V, V_{DS} = 560 V, T_J = 125°C	-	50	µA
Breakdown voltage	BV_{DSS}	V_{BP} = 6.2 V, $V_{EN/UV}$ = 0 V, T_J = 25°C, Note 5	700	-	V
DRAIN pin supply voltage			50	-	V
EN/UV pin output signal delay	$t_{EN/UV}$		-	10	µs

NOTES:
1. Total current consumption is the sum of I_{S1} and I_{DSS} when EN/UV pin is shorted to ground (MOSFET not switching) and the sum of I_{S2} and I_{DSS} when EN/UV pin is open (MOSFET switching).
2. Consumption current measurement during the output MOSFET is switching can be performed at 6.1 V on BYPASS pin.
3. BP pin is not purposed for sourcing supply current to external circuitry.
4. This parameter is derived from characterization.
5. Shutdown voltage can be verified under the specification with minimum of BV_{DSS} on an inclined DRAIN pin voltage closely, but not exceeding minimum of BV_{DSS}
6. Parameters are guaranteed for constant junction temperature T_J. Measurements of parameters have to be processed in pulse modes.

* Ambient temperature

Table 4 – Typical Electric Parameters of IK3466
(on default T_A = 25°C, SOURCE = 0 V, unless otherwise specified)

Parameter	Symbol	Mode of measurement	Typical value	Unit
Max deviation			8	kHz
Current limit delay	t_{ILD}	T_J = 25°C, Note 1, 2	150	ns
Thermal shutdown hysteresis			70	°C
Rise Time	t_R	Measured in a typical feedback IC application	50	ns
Fall Time	t_F		50	ns
Output disable setup time	t_{DST}		0,5	µs
Auto-Restart ON-Time	t_{AR}	T_J = 25°C, Note 3	50	ms
Auto-Restart Duty Cycle	D_{CAR}		5,6	%

Note
1. This parameter is derived from characterization.
2. This parameter is derived from the change in current limit measured at 1x and 4x of the di/dt shown in the I_{LIMIT} specification.
3. Auto-restart on time has the same temperature characteristics as the oscillator (inversely proportional to frequency).

Operation Description

Unlike conventional PWM (Pulse width modulator) controllers, IK3466 uses a simple ON/OFF control to regulate the output voltage. Figure 1 shows the electric block diagram.

The IK3466 consists of

- 132kHz oscillator ,
- Enable circuit (sense and logic),
- Voltage regulator 5.8 V
- Under-voltage circuit
- Leading edge circuit
- Current limit circuit
- Temperature protection circuit
- Auto-restart counter

The oscillator frequency is internally set to 132 kHz. Two signals are generated from the oscillator: the maximum duty cycle signal (DCMAX) and the Clock signal that indicates the start of each cycle.

The oscillator contain built-in circuitry that introduces a small amount of frequency jitter, typically 8 kHz peak-to-peak, to minimize EMI emission. The modulation rate of the frequency jitter is set to 1 kHz to optimize EMI reduction for both average and quasi-peak emissions. The frequency jitter should be measured with the oscilloscope synchronized at the falling edge of the waveform.

The enable input circuit at the EN/UV pin consists of a low impedance source follower output set at 1.0 V. Under most operating conditions (except when close to noload), the low impedance of the source follower keeps the voltage on the EN/UV pin from going much below 1.0 V in the disabled state. This improves the response time of the optocoupler
that is usually connected to this pin.

The 5.8 V regulator charges the bypass capacitor connected to the BYPASS pin to 5.8 V by drawing a current from the voltage on the DRAIN pin, whenever the MOSFET is off. The BYPASS pin is the internal supply voltage node for the IK3466. When the transistor VT5 is on, the IK3466operates from the energy stored in the bypass capacitor. Extremely low power consumption of the internal circuitry allows to operate continuously from current it takes from the DRAIN pin. A bypass capacitor value of 0.1 μF is sufficient for both high frequency decoupling and energy storage.

In addition, there is a 6.3 V shunt regulator clamping the BYPASS pin at 6.3 V when current is provided to the BYPASS pin through an external resistor.

The BYPASS pin under-voltage sensing circuit disables the transistor VT5 when the BYPASS pin voltage drops below 4.8 V. Once the BYPASS pin voltage drops below 4.8 V, it must rise back to 5.8 V to enable (turn-on) the transistor VT5.

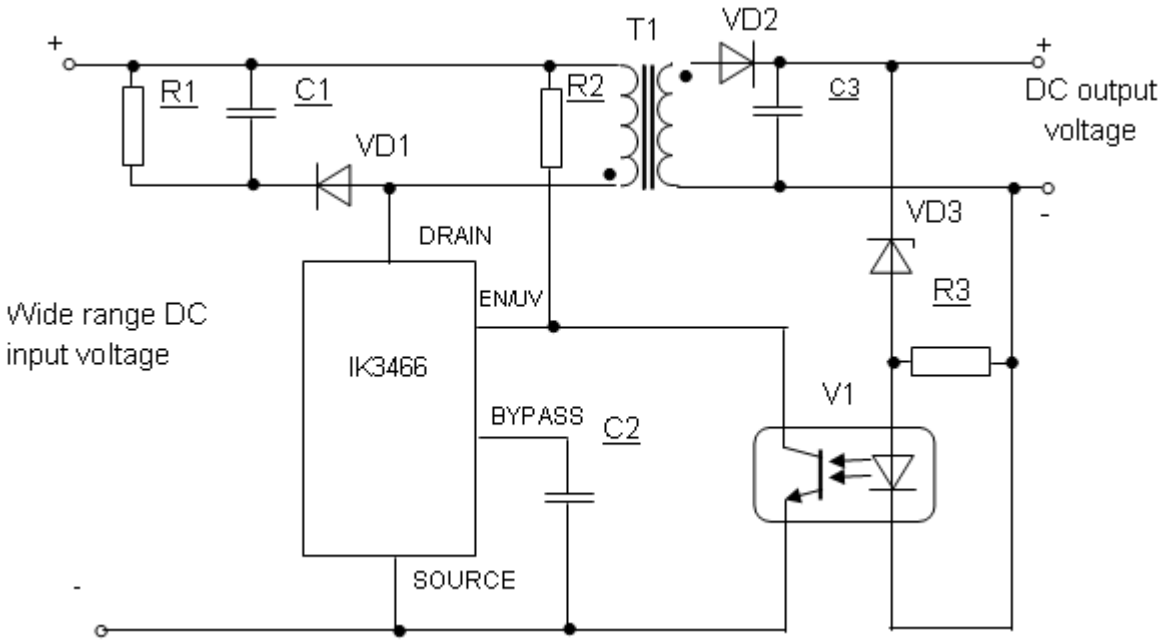
The over temperature protection circuit disables the output power transistor VT5. To prevent cyclic fault action the over temperature protection circuit has temperature hysteresis about 70^{o}C. A large temperature hysteresis (~70^{o}C) guarantees prevention of overheating of the PCB under continuous fault condition.

The current limit circuit senses the current in the transistor VT5. When this current exceeds the internal threshold (ILIMIT), the e transistor VT5 is turned off to the end of that cycle.
The current limit circuit reduces the current limit threshold under medium and light loads.

The leading edge blanking circuit inhibits the current limit comparator for a short time (tLEB) after the transistor VT5 is
turned on. This leading edge blanking time has been set so that current spikes caused by capacitance and secondary-side rectifier reverse recovery time will not cause untimely termination of the switching pulse.

In the event of a fault condition such as output overload, output short circuit, or an open loop condition, the IK3466*enters* into auto-restart mode.

If the EN/UV pin is not pulled low for 50 ms, the transistor VT5 switching is normally disabled for 850 ms (except in the case of line under-voltage condition in which case it is disabled until the condition is removed). The auto-restart alternately enables and disables the switching of the transistor VT5 until the fault condition is removed.



T1 – pulse transformer;
V1 – optoelectronic device with phototransistor;
VD1, VD2 – diodes;
VD3 – zener diode

Fig. 2 – Typical application

Typical Performance Characteristics

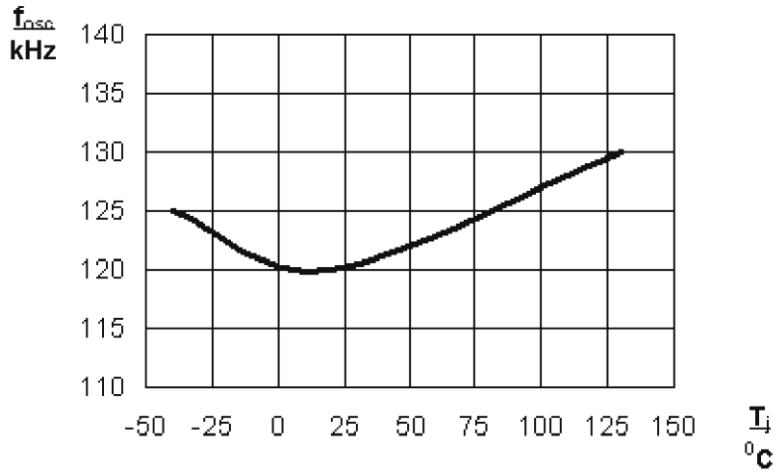


Fig. 3 – Average operating frequency f_{OSC} vs.temperature.T_j

Fig. 4 – DRAIN consumption current I_S vs DRAIN supply voltage V_D

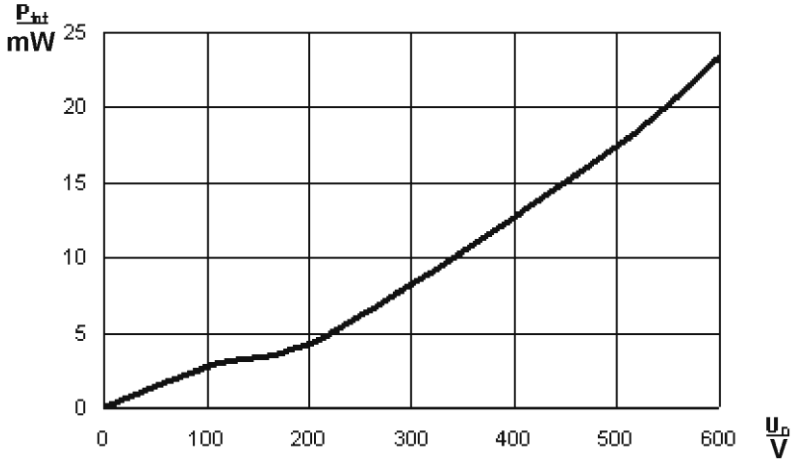
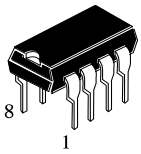
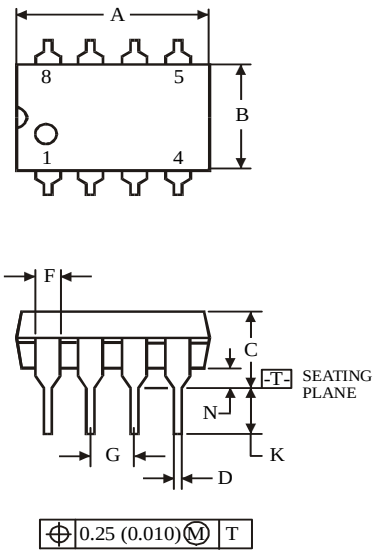


Fig. 5 –Power dissipation P_{tot} vs DRAIN supply voltage V_D

N SUFFIX PLASTIC DIP
(MS – 001BA)



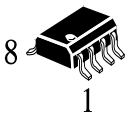


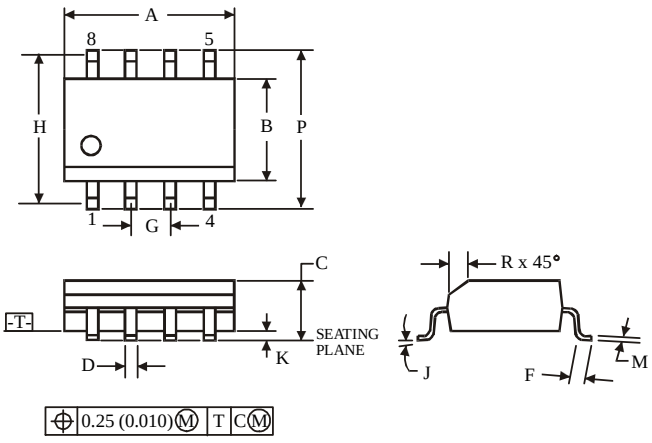
	Dimension, mm	
Symbol	**MIN**	**MAX**
A	8.51	10.16
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

1. Dimensions “A”, “B” do not include mold flash or protrusions.
   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AA)





	Dimension, mm	
Symbol	**MIN**	**MAX**
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.