Universidad del País Vasco
Euskal Herriko Unibertsitatea
BILBOKO INGENIARITZA ESKOLA
ESCUELA DE INGENIERÍA DE BILBAO

GRADO EN INGENIERÍA ELÉCTRICA

TRABAJO FIN DE GRADO

DISEÑO ELÉCTRICO Y CONTROL ELECTRÓNICO DE MICROCENTRAL HIDROELÉCTRICA AISLADA

DOCUMENTO 7 – ANEXO V: DATASHEETS

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Atmel ATmega640/V-1280/V-1281/V-2560/V-2561/V

8-bit Atmel Microcontroller with 16/32/64KB In-System Programmable Flash

DATASHEET

Features

- High Performance, Low Power Atmel® AVR® 8-Bit Microcontroller
- Advanced RISC Architecture
  - 135 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 × 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16MHz
  - On-Chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
  - 64K/128K/256KBytes of In-System Self-Programmable Flash
  - 4Kbytes EEPROM
  - 8Kbytes Internal SRAM
  - Write/Erase Cycles:10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/ 100 years at 25°C
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Software Security
    - Endurance: Up to 64Kbytes Optional External Memory Space
- Atmel® QTouch® library support
  - Capacitive touch buttons, sliders and wheels
  - QTouch and QMatrix acquisition
  - Up to 64 sense channels
- JTAG (IEEE® std. 1149.1 compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
  - Four 16-bit Timer/Counter with Separate Prescaler, Compare- and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four 8-bit PWM Channels
  - Six/Twelve PWM Channels with Programmable Resolution from 2 to 16 Bits (ATmega1281/2561, ATmega640/1280/2560)
  - Output Compare Modulator
  - 8/16-channel, 10-bit ADC (ATmega1281/2561, ATmega640/1280/2560)
  - Two/Four Programmable Serial USART (ATmega1281/2561, ATmega640/1280/2560)
  - Master/Slave SPI Serial Interface
  - Byte Oriented 2-wire Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
  - Interrupt and Wake-up on Pin Change
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- I/O and Packages
  - 54/86 Programmable I/O Lines (ATmega1281/2561, ATmega640/1280/2560)
  - 64-pad QFN/MLF, 64-lead TQFP (ATmega1281/2561)
  - 100-lead TQFP, 100-ball CBGA (ATmega640/1280/2560)
  - RoHS/Fully Green
- Temperature Range:
  - -40°C to 85°C Industrial
- Ultra-Low Power Consumption
  - Active Mode: 1MHz, 1.8V: 500µA
  - Power-down Mode: 0.1µA at 1.8V
- Speed Grade:
  - ATmega640V/ATmega1280V/ATmega1281V:
    - 0 - 4MHz @ 1.8V - 5.5V, 0 - 8MHz @ 2.7V - 5.5V
  - ATmega2560V/ATmega2561V:
    - 0 - 2MHz @ 1.8V - 5.5V, 0 - 8MHz @ 2.7V - 5.5V
  - ATmega640/ATmega1280/ATmega1281:
    - 0 - 8MHz @ 2.7V - 5.5V, 0 - 16MHz @ 4.5V - 5.5V
  - ATmega2560/ATmega2561:
    - 0 - 16MHz @ 4.5V - 5.5V

TRANSFORMERS & INDUCTORS

MYRRA

...Of course !

TECHNICAL INFORMATION

RATED PRIMARY VOLTAGE (V)
This is the supply voltage assigned to the transformer by the manufacturer.

RATED SECONDARY VOLTAGE (V)
This is the secondary output voltage assigned to the transformer when supplied with the rated primary voltage, frequency range, rated secondary current, all assigned by the manufacturer for the specified operating conditions of the transformer.

RATED POWER (VA)
The specified power levels in this catalogue are the secondary power levels, in other words, those available when the transformer is loaded. It is the product of the RMS rated secondary voltage by the RMS rated current. If the transformer has more than one output winding, the rated power denotes the maximum sum of the products of RMS rated secondary voltage by the RMS rated secondary current, respectively. This rated power is defined for rated ambient temperature conditions.
example : P = 3,2 VA ta 70/B
The transformer can deliver 3.2VA at maximum ambient (70°C), the load consisting of a resistor load defined by R(load) = U(sec)²/P (assigned U sec & P values), heating does not exceed the relevant limit for Class B components used in this construction.

NOTE : When the transformer is intended to supply DC voltage and current in conjunction with rectifiers and smoothing capacitors, the VA power required from the transformer is far higher than the U(DC) and I(DC) product. To help you to determine the true transformer power, our Technical Department is at your disposal.

AMBIENT TEMPERATURE (ta)
The maximum temperature at which the transformer may be operated continuously under nominal conditions of use. It is the air temperature measured close to the transformer after thermal stabilization when operating at rated conditions.

HEATING
The increase of the winding temperature when operating at rated conditions and maximum ambient temperature. The heating must be determined by the resistance method.

TEMPERATURE CLASS
The international classification of temperature classes is as follows :

A	105°C	H	180 °C
E	120°C	200	200 °C
B	130°C	220	220 °C
F	155°C	250	250 °C

It defines the maximum temperature the transformer components must withstand in continuous operation, in compliance with the N° 85 IEC publication classification. There insulating materials are therefore certificated for the thermal index corresponding to the declared class in accordance with N° 216 IEC standard.

PARTICULAR POINTS OF EN 61558-2-6 STANDARD FOR SAFETY TRANSFORMERS
On-load secondary voltage tolerance.

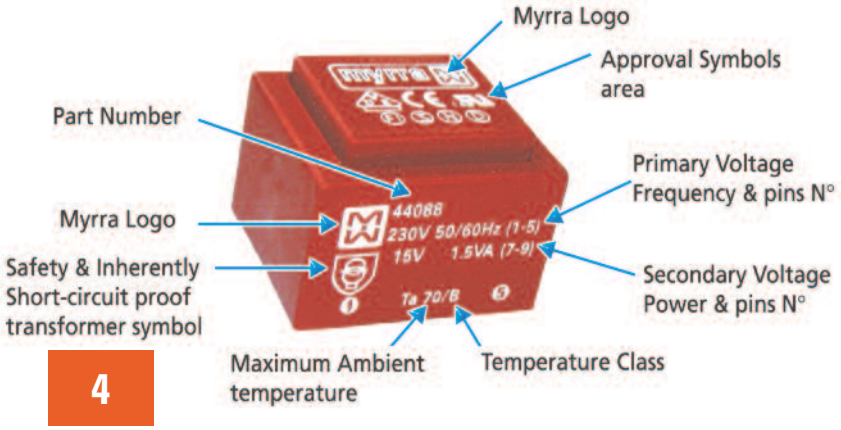
This should not differ from the rated value by more than :
10% for transformers with build-in resistance to short-circuits (a supplement of 5% is granted on the 2 nd secondary for tranformers with 2 secondaries).
5% for other transformers whatever the secondaries number.

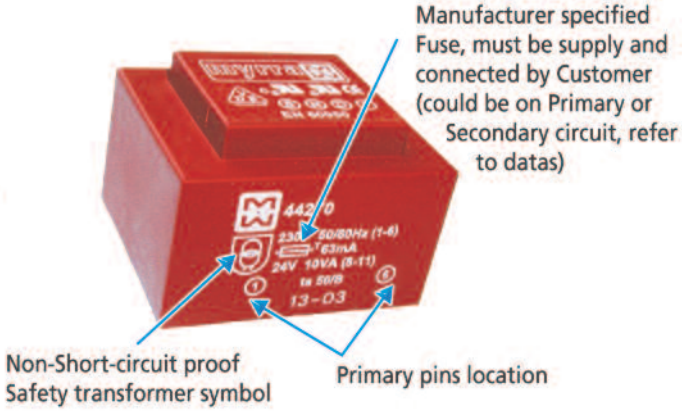
Off-load secondary voltage.

The values given in this catalogue are maximum theoretical values.
NOTE : For safety transformers, this should never exceed 50 V rms. In the case of a transformer with several secondaries, the sum of the secondary voltages should be less tan 50 V rms.

ADAPTED TRANSFORMERS FROM THE STANDARDS SERIES
Any transformer whose requires Power and Ambient corresponding to those of our 44000 & 45000 range, and whose secondary voltage can fit in our minimum to maximum secondary range will be covered by EN61558-2-6,EN60950, or UL506 approvals, depending on the effective choice .

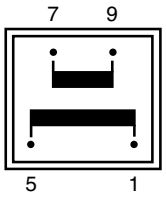
SPECIAL TRANFORMERS
MYRRA can use the 44000, 45000 or 46000 standard ranges to examine any transformer for compliance with your specifications and with international standards.
On request, we can add thermal protection, thermal fuse, thermal switch-CTP.
In certain cases, the addition of thermal protection enables the ambient temperature to be increased, while still complying with EN 61558.

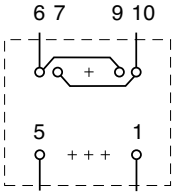


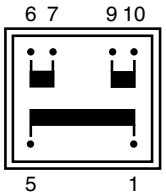


EN 61558-2-6 EN 60950 UL 1585

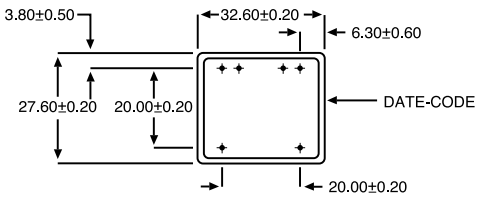
- Vacuum filling
- Two compartments bobbins
- Self-extinguishing plastics UL 94 VO
- Degree of protection IP 00
- 40 grams weight
- Resin class B CEI 85 (20 000 h testing to CEI 126)
- Inherently short-circuits proof
- Insulation voltage 4 KV
- 100 % tested production
- Certification : CCA procedure on request

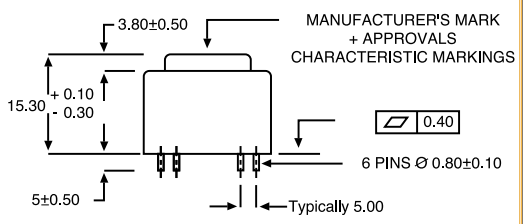






Recommended layout for transformers with 1 secondary winding
(Allows the use of a transformer with 2 secondary windings)





** RECOMMENDED DRILL-HOLE DIAMETER FOR 1,3 mm PINS

QUALITY IN SERIES

PRIMARY VOLTAGE 117 V

Protection	Reference	Secondary voltage V	Secondary current m A	No-load voltage V	Ambient Temperature °C	Rating VA
	44025	6	100	9,94	T 70 B	0,6
	44026	9	66	14,95	T 70 B	0,6
	44027	12	50	19,9	T 70 B	0,6
	44028	15	40	24,9	T 70 B	0,6
	44029	18	33	29,9	T 70 B	0,6
	44030	24	25	39,8	T 70 B	0,6
	44031	2 x 6	2 x 50	2 x 9,94	T 70 B	0,6
	44032	2 x 9	2 x 33	2 x 14,95	T 70 B	0,6
	44033	2 x 12	2 x 25	2 x 19,9	T 70 B	0,6
	44034	2 x 15	2 x 20	2 x 24,9	T 70 B	0,6
	44035	2 x 18	2 x 17	2 x 29,9	T 70 B	0,6
	44036	2 x 24	2 x 12	2 x 39,8	T 70 B	0,6

PRIMARY VOLTAGE 230 V

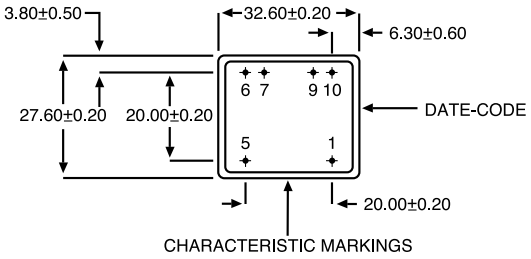
Protection	Reference	Secondary voltage V	Secondary current m A	No-load voltage V	Ambient Temperature °C	Rating VA
	44013	6	100	9,94	T 70 B	0,6
	44014	9	66	14,95	T 70 B	0,6
	44015	12	50	19,9	T 70 B	0,6
	44016	15	40	24,9	T 70 B	0,6
	44017	18	33	29,9	T 70 B	0,6
	44018	24	25	39,8	T 70 B	0,6
	44019	2 x 6	2 x 50	2 x 9,94	T 70 B	0,6
	44020	2 x 9	2 x 33	2 x 14,95	T 70 B	0,6
	44021	2 x 12	2 x 25	2 x 19,9	T 70 B	0,6
	44022*	2 x 15	2 x 20	2 x 24,9	T 70 B	0,6
	44023*	2 x 18	2 x 17	2 x 29,9	T 70 B	0,6
	44024*	2 x 24	2 x 12	2 x 39,8	T 70 B	0,6

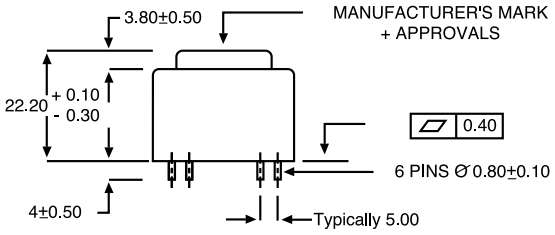
*To be noted : * marked transformers are non approved.
Those transformers meet all requirement of EN 61558-2-4.

KEMA KEUR **EN 61558-2-6** **EN 60950** **UL 1585**

- Insulation voltage 4 KV
- 100 % tested production
- Certification : CCA procedure on request

*To be noted 2 x 15 V and 2 x 24 V models are non-approved.
Those transformers meet all requirement of EN 61558-2-4





** RECOMMENDED DRILL-HOLE DIAMETER FOR 1,3 mm PINS

PRIMARY VOLTAGE 230 V

Protection	Reference	Secondary voltage V	Secondary current m A	No-load voltage V	Ambient Temperature °C	Rating VA
	44049•	6	167	8,6	T 70 B	1
	44050•	9	111	12,9	T 70 B	1
	44051•	12	83	17,2	T 70 B	1
	44052•	15	67	21,6	T 70 B	1
	44053•	18	56	25,9	T 70 B	1
	44054•	24	42	37,9	T 70 B	1
	44055•	2 x 6	2 x 83	2 x 8,6	T 70 B	1
	44056•	2 x 9	2 x 56	2 x 12,9	T 70 B	1
	44057•	2 x 12	2 x 42	2 x 19	T 70 B	1
	44058•	2 x 15	2 x 33	2 x 23,6	T 70 B	1
	44059•	2 x 18	2 x 28	2 x 24,9	T 70 B	1
	44060**	2 x 24	2 x 21	2 x 37,9	T 70 B	1

• Items usually available on stock

	44326	6	250	10,1	ta 70/B	1,5
	44327	9	167	15,3	ta 70/B	1,5
	44328	12	125	20,2	ta 70/B	1,5
	44329	15	100	25,3	ta 70/B	1,5
	44330	18	83	31,2	ta 70/B	1,5
	44331	24	63	43,3	ta 70/B	1,5
	44332	2 x 6	125	2 x 10,1	ta 70/B	1,5
	44333	2 x 9	83	2 x 15,3	ta 70/B	1,5
	44334	2 x 12	63	2 x 20,2	ta 70/B	1,5
	44335	2 x 15	50	2 x 25,0	ta 70/B	1,5
	44336*	2 x 18	42	2 x 31	ta 70/B	1,5
	44337*	2 x 24	31	2 x 43	ta 70/B	1,5

	44830	6	300	10,1	ta 70/B	1,8
	44831	9	200	15,2	ta 70/B	1,8
	44832	12	150	20,3	ta 70/B	1,8
	44833	15	120	27,3	ta 70/B	1,8
	44834	18	100	30,4	ta 70/B	1,8
	44835	24	75	40,6	ta 70/B	1,8
	44836	2 x 6	2 x 150	2 x 10,1	ta 70/B	1,8
	44837	2 x 9	2 x 100	2 x 15,2	ta 70/B	1,8
	44838	2 x 12	2 x 75	2 x 20,3	ta 70/B	1,8
	44839*	2 x 15	2 x 60	2 x 27,3	ta 70/B	1,8

LITEON OPTOELECTRONICS

Data Sheet

Photocouplers
LTV-814 824 844 (M, S, S-TA, S-TA1, S-TP) SERIES

1. DESCRIPTION

1.1 Features

- Current transfer ratio (CTR : MIN. 20% at I_F = ±1mA, V_{CE} = 5V)
- Response time (tr : TYP. 4μs at VCE = 2V, IC = 2mA, RL = 100Ω)
- AC input response
- Low collector dark current (I_{CEO} :MAX.10^{-7} A at V_{CE}=20V)
- High input-output isolation voltage (Viso = 5,000Vrms)
- Dual-in-line package :
  LTV-814 : 1-Channel type
  LTV-824 : 2-Channel type
  LTV-844 : 4-Channel type
- Wide lead spacing package :
  LTV-814M : 1-Channel type
  LTV-824M : 2-Channel type
  LTV-844M : 4-Channel type
- Surface mounting package :
  LTV-814S : 1-Channel type
  LTV-824S : 2-Channel type
  LTV-844S : 4-Channel type
- Tape and reel packaging :
  LTV-814S-TA, LTV-814S-TA1, LTV-814S-TP : 1-Channel type
  LTV-824S-TA, LTV-824S-TA1 : 2-Channel type
- Safety approval
  UL approved (No. E113898)
  CSA approved (No. CA91533-1)
  FIMKO approved (No. 193422-01)
  VDE approved (No. 40015248)
- RoHS Compliance
- All materials be used in device are followed EU RoHS directive (No.2002/95/EC).
- ESD pass HBM 8000V/MM2000V
- MSL class1

1.2 Applications

- AC line monitor
- Unknown polarity DC sensor
- Telephone line interface

4. RATING AND CHARACTERISTICS

4.1 Absolute Maximum Ratings at Ta=25°C

Parameter		Symbol	Rating	Unit
Input	Forward Current	I_F	±50	mA
	Power Dissipation	P	70	mW
Output	Collector - Emitter Voltage	V_{CEO}	35	V
	Emitter - Collector Voltage	V_{ECO}	6	V
	Collector Current	I_C	50	mA
	Collector Power Dissipation	P_C	160	mW
Total Power Dissipation		P_{tot}	200	mW
*1 Isolation Voltage		V_{iso}	5000	V_{rms}
Operating Temperature (LTV-824 / 844)		T_{opr}	-30 ~ +100	°C
Operating Temperature (LTV-814)		T_{opr}	-30 ~ +110	°C
Storage Temperature		T_{stg}	-55 ~ +150	°C
*2 Soldering Temperature		T_{sol}	260	°C

*1. AC For 1 Minute, R.H. = 40 ~ 60%

Isolation voltage shall be measured using the following method.

(1) Short between anode and cathode on the primary side and between collector and emitter on the secondary side.

(2) The isolation voltage tester with zero-cross circuit shall be used.

(3) The waveform of applied voltage shall be a sine wave.

*2. For 10 Seconds

4.2 ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C

PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
INPUT	Forward Voltage	V_F	—	1.2	1.4	V	IF=±20mA
	Terminal Capacitance	C_t	—	50	250	pF	V=0, f=1KHz
OUTPUT	Collector Dark Current	I_{CEO}	—	—	100	nA	VCE=20V, IF=0
	Collector-Emitter Breakdown Voltage	B_{VCEO}	35	—	—	V	IC=0.1mA IF=0
	Emitter-Collector Breakdown Voltage	B_{VECO}	6	—	—	V	IE=10μA IF=0
TRANSFER CHARACTERISTICS	Collector Current	IC	0.2	—	3	mA	IF=±1mA VCE=5V
	*Current Transfer Ratio	CTR	20	—	300	%	
	Collector-Emitter Saturation Voltage	V_{CE}(sat)	—	0.1	0.2	V	IF=±20mA IC=1mA
	Isolation Resistance	Riso	5×10^{10}	1×10^{11}	—	Ω	DC500V 40 ~ 60% R.H.
	Floating Capacitance	Cf	—	0.6	1	pF	V=0, f=1MHz
	Response Time (Rise)	tr	—	4	18	μs	VCE=2V, IC=2mA
	Response Time (Fall)	tf	—	3	18	μs	RL=100Ω

$$*\mathrm{CTR} = \frac{I_C}{I_F} \times 100\%$$

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 16216 SYH-LY

Product Specification ***Version: 2***

13/Oct/2008

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1. FUNCTIONS & FEATURES

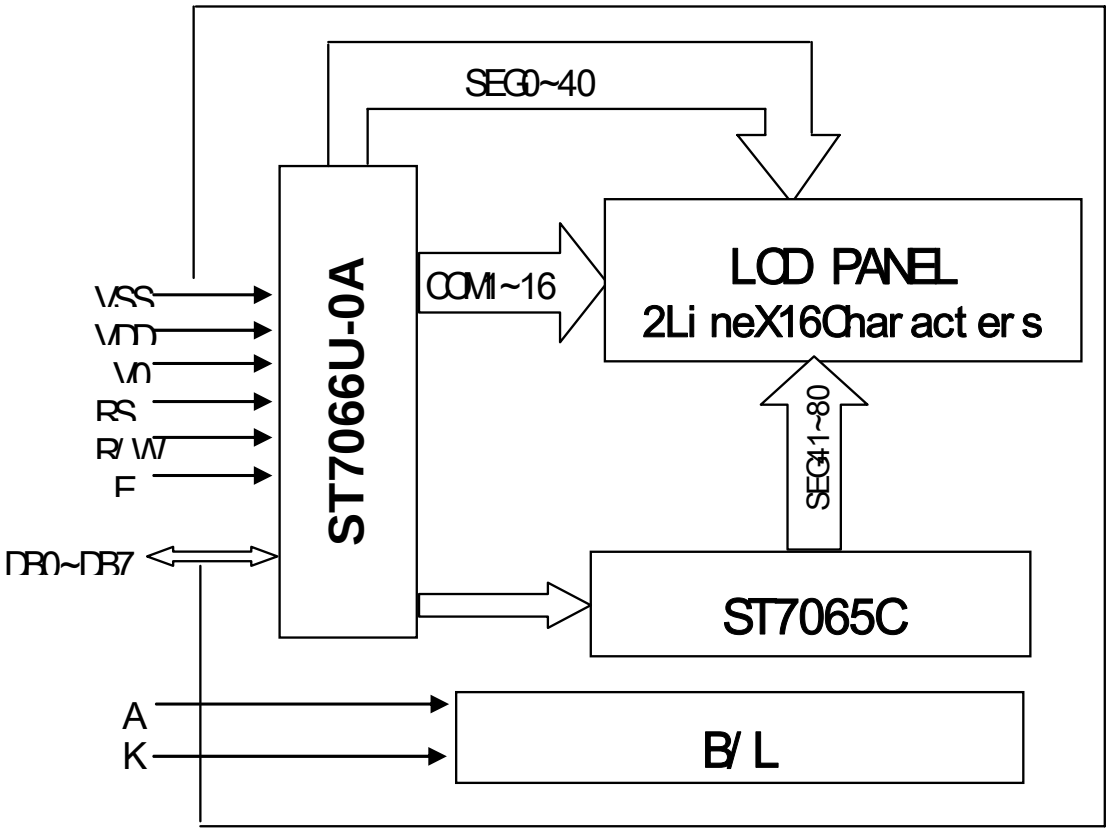
MODULE NAME	LCD TYPE
DEM 16216 SYH-LY	STN Yellow Green Transflective Positive Mode

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/16 Duty Cycle, 1/5 Bias
- Power Supply Voltage : 5.0 Volt (typ.)
- Backlight Color : LED, Lightbox, Yellow-Green
- V_{LCD} Adjustable For Best Contrast : 4.5 Volt (typ.)
- Display contents : 16 x 2 Characters (5 x 8 dots, Format : 192 Kinds)
- Internal Memory : CGROM (8,320 bits)
  : CGRAM (64 x 8 bits)
  : DDRAM (80 x 8 bits for 80 Digits)
- Interface : Easy Interface with a 4-bit or 8-bit MPU
- Operating Temperature : -20°C to +70°C
- Storage Temperature : -25°C to +75°C

2. MECHANICAL SPECIFICATIONS

- Module Size : 80.00 x 36.00 x 11.9 mm
- Character Pitch : 3.55 x 5.95 mm
- Character Size : 2.95 x 5.55 mm
- Character Font : 5 x 8 dots
- Dot Size : 0.55 x 0.65 mm
- Dot Pitch : 0.60 x 0.70 mm

4. BLOCK DIAGRAM



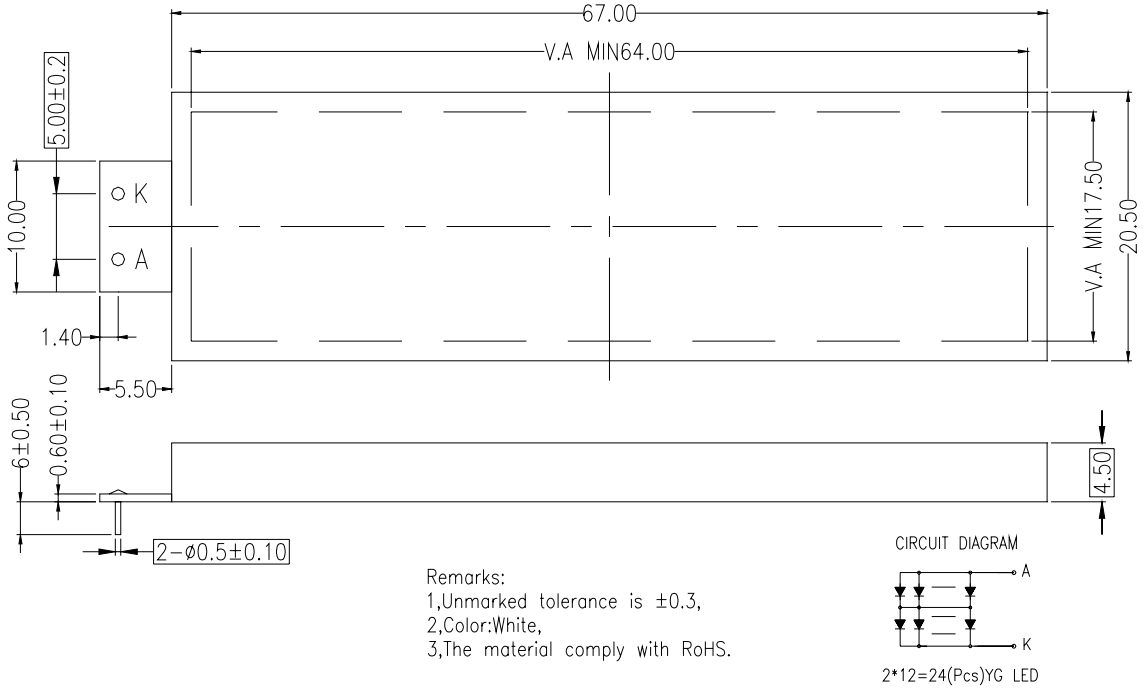
5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground terminal of module.
2	VDD	Supply terminal of module 5.0V.
3	V0	Power Supply for liquid crystal drive.
4	RS	Register select RS = 0 (Instruction register) RS = 1 (Data register)
5	R/W	Read /Write R/W = 1(Read) R/W = 0 (Write)
6	E	Enable
7	DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED – (K)	Please also refer to 6.1 PCB drawing and description.
16	LED + (A)	Please also refer to 6.1 PCB drawing and description.

7. BACKLIGHT ELECTRONICS/OPTICAL SPECIFICATIONS

Electronics/Optical Specifications:

	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Forward Voltage	Vf	3.6	4.2	4.6	V	If=150mA
Forward Current	If		150		mA	
Power Dissipation	Pd		0.63		W	If=150mA
Reverse Voltage	VR			10.0	V	
Reverse Current	IR			1.1	mA	
Luminous Intensity	Iv	250	350	500	cd/m^2	If=150mA
Luminous Uniformity		70			%	If=150mA
Emission Wavelength	λP	569	572	575	nm	If=10mA Ta=25°C Each chip



8. MAXIMUM ABSOLUTE POWER RATINGS (Ta=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage(1)	V_{DD}	-0.3~+7.0	V
Power supply voltage(2)	V_{LCD}	V_{DD}-10.0~V_{DD}+0.3	V
Input voltage	V_{IN}	-0.3~V_{DD}+0.3	V
Operating temperature	T_{opr}	-20~+70	°C
Storage temperature	T_{stg}	-25~+75	°C

10-2 AC Characteristics

(TA = 25℃, VCC = 5V)

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
f_{OSC}	OSC Frequency	R = 91KΩ	190	270	350	KHz
External Clock Operation						
f_{EX}	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Interface Mode with LCD Driver(ST7065)						
T_{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T_{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T_{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T_{SU}	Data Setup Time	Pin: D	300	-	-	ns
T_{DH}	Data Hold Time	Pin: D	300	-	-	ns
T_{DM}	M Delay Time	Pin: M	0	-	2000	ns

September 2014

LM78XX / LM78XXA
3-Terminal 1 A Positive Voltage Regulator

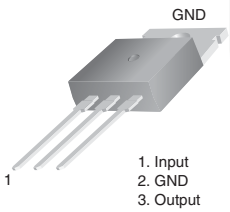
Features

- Output Current up to 1 A
- Output Voltages: 5, 6, 8, 9, 10, 12, 15, 18, 24 V
- Thermal Overload Protection
- Short-Circuit Protection
- Output Transistor Safe Operating Area Protection

Description

The LM78XX series of three-terminal positive regulators is available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut-down, and safe operating area protection. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed-voltage regulators, these devices can be used with external components for adjustable voltages and currents.

TO-220 (Single Gauge)



Ordering Information(1)

Product Number	Output Voltage Tolerance	Package	Operating Temperature	Packing Method
LM7805CT	±4%	TO-220 (Single Gauge)	-40°C to +125°C	Rail
LM7806CT				
LM7808CT				
LM7809CT				
LM7810CT				
LM7812CT				
LM7815CT				
LM7818CT				
LM7824CT				
LM7805ACT	±2%		0°C to +125°C	
LM7809ACT				
LM7810ACT				
LM7812ACT				
LM7815ACT				

Note:

1. Above output voltage tolerance is available at 25°C.

Block Diagram

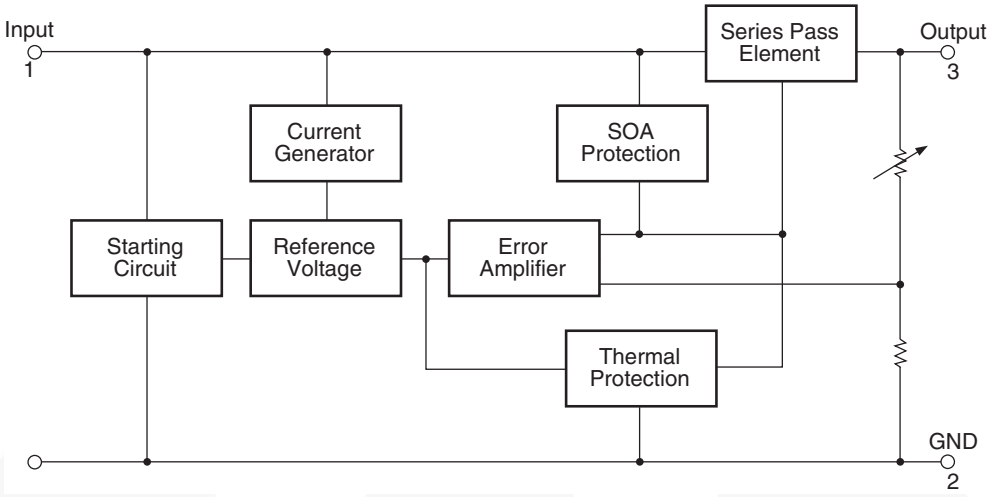


Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter		Value	Unit
V_I	Input Voltage	V_O = 5 V to 18 V	35	V
		V_O = 24 V	40	
$R_{\theta JC}$	Thermal Resistance, Junction-Case (TO-220)		5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-Air (TO-220)		65	°C/W
T_{OPR}	Operating Temperature Range	LM78xx	-40 to +125	°C
		LM78xxA	0 to +125	
T_{STG}	Storage Temperature Range		- 65 to +150	°C

Electrical Characteristics (LM7805)

Refer to the test circuit, -40°C < T_J < 125°C, I_O = 500 mA, V_I = 10 V, C_I = 0.1 µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		4.80	5.00	5.20	V
		I_O = 5 mA to 1 A, $P_O \leq$ 15 W, V_I = 7 V to 20 V		4.75	5.00	5.25	
Regline	Line Regulation[2]	T_J = +25°C	V_I = 7 V to 25 V		4.0	100.0	mV
			V_I = 8 V to 12 V		1.6	50.0	
Regload	Load Regulation[2]	T_J = +25°C	I_O = 5 mA to 1.5 A		9.0	100.0	mV
			I_O = 250 mA to 750 mA		4.0	50.0	
I_Q	Quiescent Current	T_J = +25°C			5	8	mA
ΔI_Q	Quiescent Current Change	I_O = 5 mA to 1 A			0.03	0.50	mA
		V_I = 7 V to 25 V			0.30	1.30	
$\Delta V_O/\Delta T$	Output Voltage Drift[3]	I_O = 5 mA			-0.8		mV/°C
V_N	Output Noise Voltage	f = 10 Hz to 100 kHz, T_A = +25°C			42		µV
RR	Ripple Rejection[3]	f = 120 Hz, V_I = 8 V to 18 V		62	73		dB
V_{DROP}	Dropout Voltage	T_J = +25°C, I_O = 1 A			2		V
R_O	Output Resistance[3]	f = 1 kHz			15		mΩ
I_{SC}	Short-Circuit Current	T_J = +25°C, V_I = 35 V			230		mA
I_{PK}	Peak Current[3]	T_J = +25°C			2.2		A

Notes:

2. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
3. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7805A)

Refer to the test circuit, 0°C < T_J < 125°C, I_O = 1 A, V_I = 10 V, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		4.9	5.0	5.1	V
		I_O = 5 mA to 1 A, $P_O \leq$ 15 W, V_I = 7.5 V to 20 V		4.8	5.0	5.2	
Regline	Line Regulation[20]	V_I = 7.5 V to 25 V, I_O = 500 mA			5.0	50.0	mV
		V_I = 8 V to 12 V			3.0	50.0	
		T_J = +25°C	V_I = 7.3 V to 20 V		5.0	50.0	
			V_I = 8 V to 12 V		1.5	25.0	
Regload	Load Regulation[20]	T_J = +25°C, I_O = 5 mA to 1.5 A			9	100	mV
		I_O = 5 mA to 1 A			9	100	
		I_O = 250 mA to 750 mA			4	50	
I_Q	Quiescent Current	T_J = +25°C			5	6	mA
ΔI_Q	Quiescent Current Change	I_O = 5 mA to 1 A				0.5	mA
		V_I = 8 V to 25 V, I_O = 500 mA				0.8	
		V_I = 7.5 V to 20 V, T_J = +25°C				0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift[21]	I_O = 5 mA			-0.8		mV/°C
V_N	Output Noise Voltage	f = 10 Hz to 100 kHz, T_A = +25°C			42		µV
RR	Ripple Rejection[21]	f = 120 Hz, V_O = 500 mA, V_I =8 V to 18 V			68		dB
V_{DROP}	Dropout Voltage	I_O = 1 A, T_J = +25°C			2		V
R_O	Output Resistance[21]	f = 1 kHz			17		mΩ
I_{SC}	Short-Circuit Current	V_I = 35 V, T_J = +25°C			250		mA
I_{PK}	Peak Current[21]	T_J = +25°C			2.2		A

Notes:

20. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
21. These parameters, although guaranteed, are not 100% tested in production.

Typical Applications (Continued)

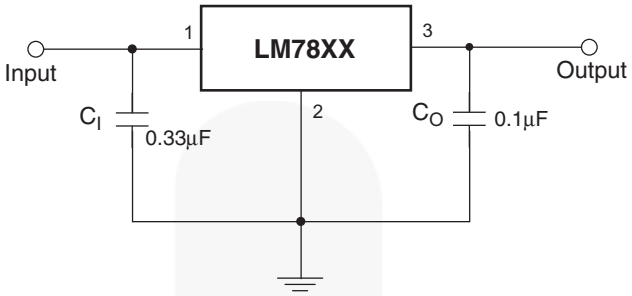


Figure 9. Fixed-Output Regulator

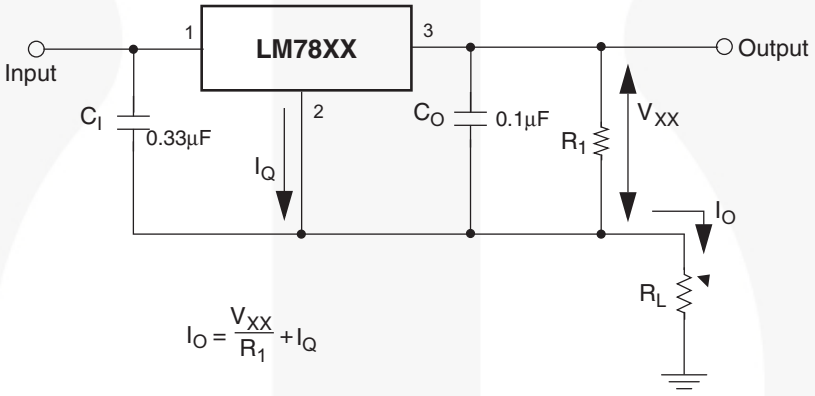


Figure 10. Constant Current Regulator

Notes:

29. To specify an output voltage, substitute voltage value for “XX”. A common ground is required between the input and the output voltage. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.
30. C_I is required if regulator is located an appreciable distance from power supply filter.
31. C_O improves stability and transient response.

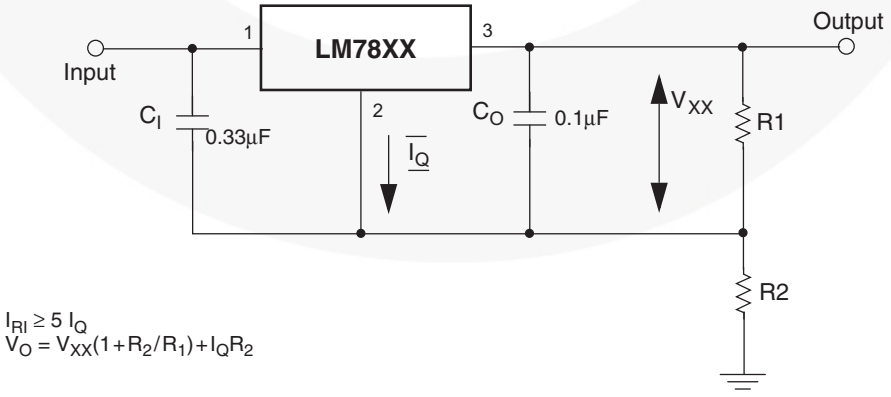
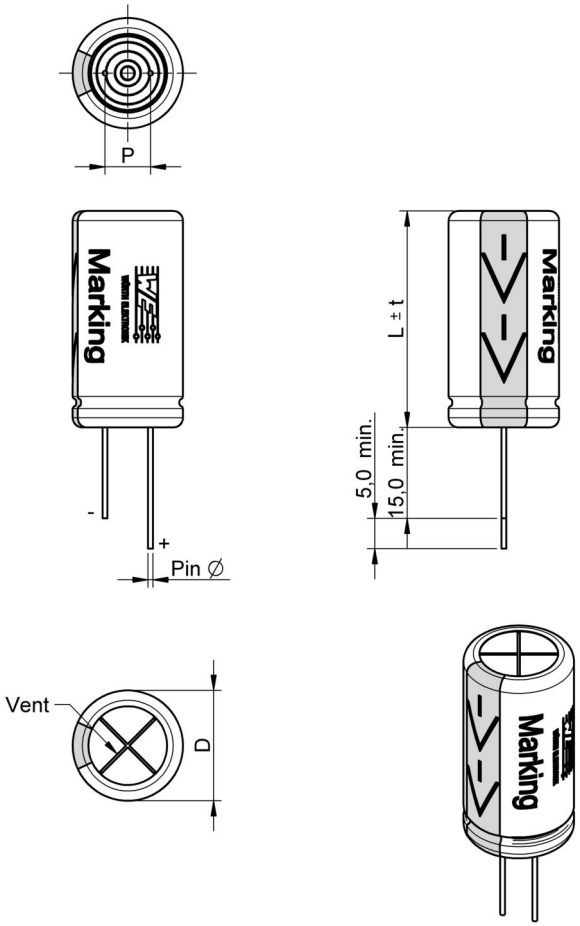


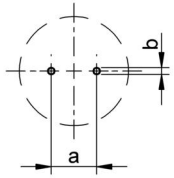
Figure 11. Circuit for Increasing Output Voltage

A Dimensions: [mm]

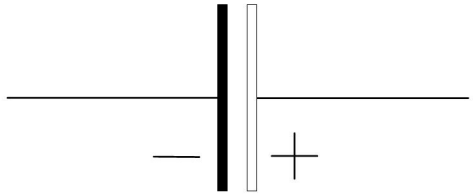


D ±0.5	5.0
P ±0.5	2.0
L ±t	11.0
t	1.5
Pin Ø ±0.02	0.5
a	2.0
b	0.8

B Recommended hole pattern: [mm]



C Schematic:



WÜRTH ELEKTRONIK

D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	0.1	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	3	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	120Hz @85°C	I_{ripple}	3.3	mA	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-40 °C bis +85 °C
Load Life:	2000 h @ +85°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

1.0	2014-11-11	SSt	PSL
REV	DATE	BY	CHECKED

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
www.we-online.com
eiSos@we-online.com

DESCRIPTION

WCAP-ATG8 Aluminum Electrolytic Capacitors

Order.- No.

860010672001

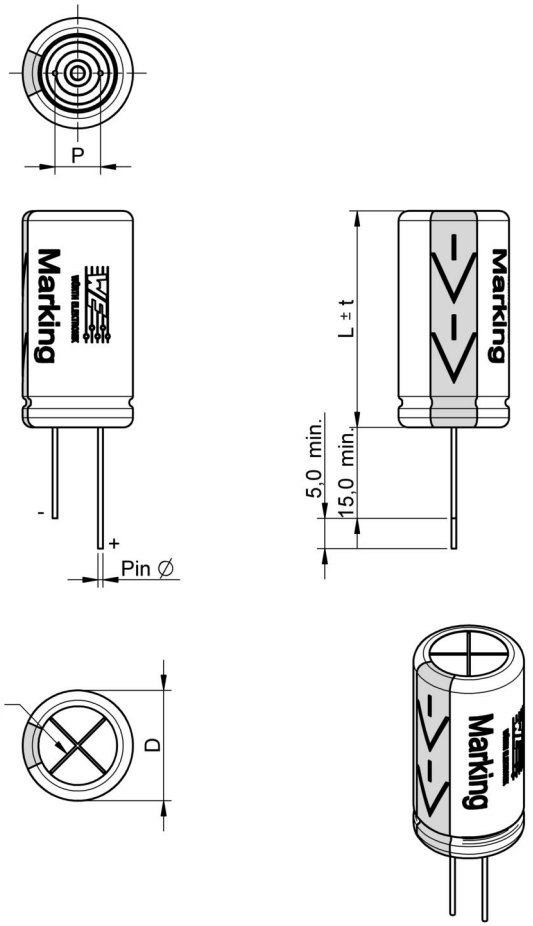
COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE

A4

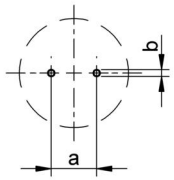
Size: 5.0 x 11.0

A Dimensions: [mm]

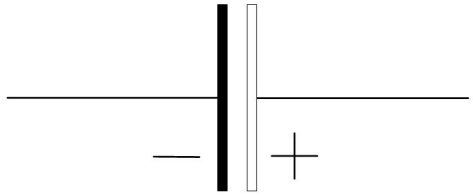


D ±0.5	10.0
P ±0.5	5.0
L ±t	12.5
t	1.5
Pin Ø ±0.02	0.6
a	5.0
b	0.9

B Recommended hole pattern: [mm]



C Schematic:



D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	180	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	90	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	120Hz @85°C	I_{ripple}	418	mA	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-40 °C bis +85 °C
Load Life:	2000 h @ +85°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

REV	DATE	BY	CHECKED
1.0	2014-11-11	SSt	PSL

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
www.we-online.com
eiSos@we-online.com

DESCRIPTION

WCAP-ATG8 Aluminum Electrolytic Capacitors

Order.- No.

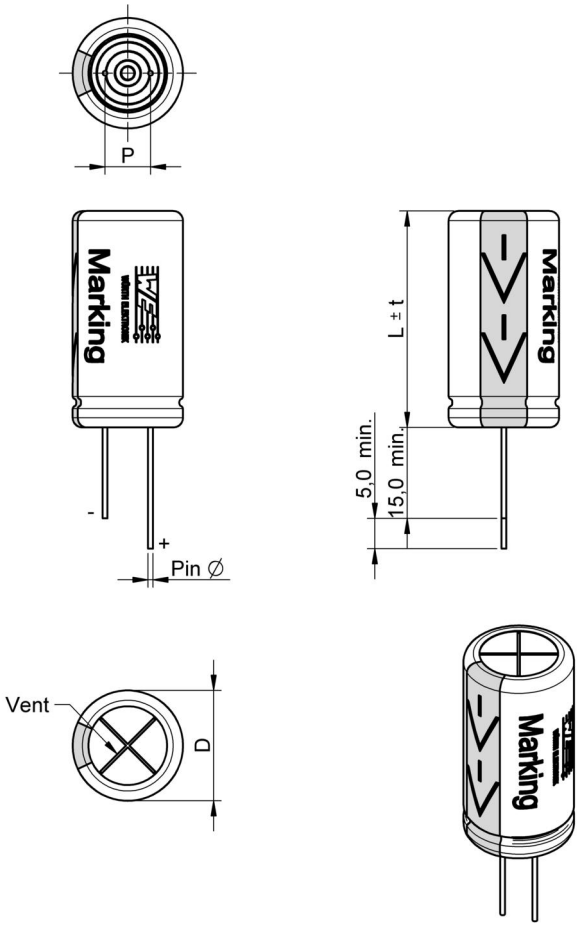
860010675017

COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE: A4

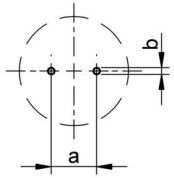
Size: 10.0 x 12.5

A Dimensions: [mm]

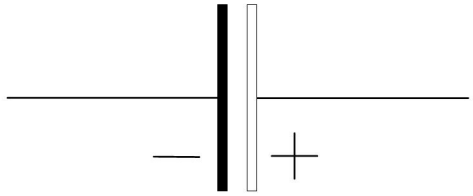


D ±0.5	5.0
P ±0.5	2.0
L ±t	11.0
t	1.5
Pin Ø ±0.02	0.5
a	2.0
b	0.8

B Recommended hole pattern: [mm]



C Schematic:



WÜRTH ELEKTRONIK

D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	0.33	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	3	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	120Hz @85°C	I_{ripple}	5.5	mA	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-40 °C bis +85 °C
Load Life:	2000 h @ +85°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

REV	DATE	BY	CHECKED
1.0	2014-11-11	SSt	PSL

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
www.we-online.com
eiSos@we-online.com

DESCRIPTION

WCAP-ATG8 Aluminum Electrolytic Capacitors

Order.- No.

860010672003

COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE

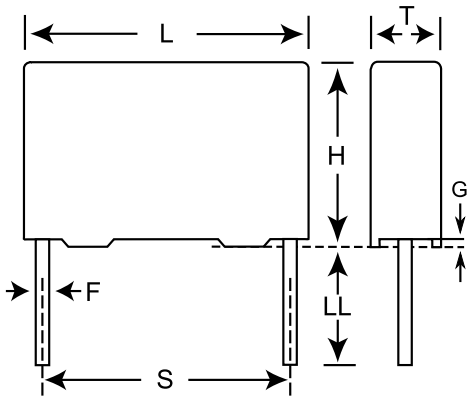
A4

Size: 5.0 x 11.0

KEMET Part Number: PFR5102J63J11L4BULK

(F411JH102J063C)

Capacitor, Film, Film-Foil Polypropylene, 1000 pF, +/-5% Tol, -55/+100C, General Purpose, 63 VDC@85C, Lead Spacing=5 mm



General Information	
Supplier:	KEMET
Dielectric:	Film-Foil Polypropylene
Application:	General Purpose
Sub Application:	DC or AC applications
Style:	Radial Box
Lead Form:	Wire Leads
Features:	Pulse
RoHS:	Yes

Dimensions (mm)		
Symbol	**Dimension**	**Tolerance**
L	7.2	MAX
H	6	MAX
T	4.5	MAX
S	5	-0.4
LL	4	+1
G	0.5	NOM
F	0.5	+/-0.05

Specifications	
Capacitance:	1000 pF
Voltage:	63 VDC
Tolerance:	+/-5%
Voltage AC:	40 VAC
Rated Temperature:	85C
Temperature Range:	-55/+100C
Dissipation Factor @ 1 kHz:	0.04%
Dissipation Factor @ 10 kHz:	0.04%
Dissipation Factor @ 100kHz:	0.05%
Insulation Resistance:	30000 GOhm
Inductance:	6
Maximum dVdT:	1000 v/us
Miscellaneous:	An Operating Temperature Up To +105C Is Allowed Under Certain Conditions. Please Consult Kemet For Details.

Packaging Specifications	
Package Kind:	Bulk
Package Quantity:	1000

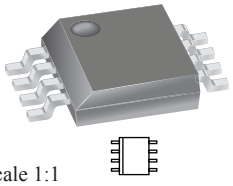
Fully Integrated, Hall Effect-Based Linear Current Sensor IC with 2.1 kVRMS Isolation and a Low-Resistance Current Conductor

Features and Benefits

- Low-noise analog signal path
- Device bandwidth is set via the new FILTER pin
- 5 µs output rise time in response to step input current
- 80 kHz bandwidth
- Total output error 1.5% at T_A = 25°C
- Small footprint, low-profile SOIC8 package
- 1.2 mΩ internal conductor resistance
- 2.1 kVRMS minimum isolation voltage from pins 1-4 to pins 5-8
- 5.0 V, single supply operation
- 66 to 185 mV/A output sensitivity
- Output voltage proportional to AC or DC currents
- Factory-trimmed for accuracy
- Extremely stable output offset voltage
- Nearly zero magnetic hysteresis
- Ratiometric output from supply voltage

TÜV America
Certificate Number:
U8V 06 05 54214 010

Package: 8 Lead SOIC (suffix LC)



Approximate Scale 1:1

Description

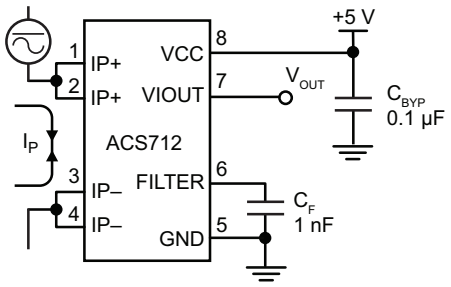
The Allegro™ ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switch-mode power supplies, and overcurrent fault protection. The device is not intended for automotive applications.

The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.

The output of the device has a positive slope (>$V_{IOUT(Q)}$) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss. The thickness of the copper conductor allows survival of

Continued on the next page…

Typical Application



Application 1. The ACS712 outputs an analog signal, V_{OUT}. that varies linearly with the uni- or bi-directional AC or DC primary sampled current, I_P, within the range specified. C_F is recommended for noise management, with values that depend on the application.

Description (continued)

the device at up to 5× overcurrent conditions. The terminals of the conductive path are electrically isolated from the signal leads (pins 5 through 8). This allows the ACS712 to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.

The ACS712 is provided in a small, surface mount SOIC8 package. The leadframe is plated with 100% matte tin, which is compatible with standard lead (Pb) free printed circuit board assembly processes. Internally, the device is Pb-free, except for flip-chip high-temperature Pb-based solder balls, currently exempt from RoHS. The device is fully calibrated prior to shipment from the factory.

Selection Guide

Part Number	Packing*	T_A (°C)	Optimized Range, I_P (A)	Sensitivity, Sens (Typ) (mV/A)
ACS712ELCTR-05B-T	Tape and reel, 3000 pieces/reel	–40 to 85	±5	185
ACS712ELCTR-20A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±20	100
ACS712ELCTR-30A-T	Tape and reel, 3000 pieces/reel	–40 to 85	±30	66

*Contact Allegro for additional packing options.

Absolute Maximum Ratings

Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	V_{CC}		8	V
Reverse Supply Voltage	V_{RCC}		–0.1	V
Output Voltage	V_{IOUT}		8	V
Reverse Output Voltage	V_{RIOUT}		–0.1	V
Output Current Source	$I_{IOUT(Source)}$		3	mA
Output Current Sink	$I_{IOUT(Sink)}$		10	mA
Overcurrent Transient Tolerance	I_P	1 pulse, 100 ms	100	A
Nominal Operating Ambient Temperature	T_A	Range E	–40 to 85	ºC
Maximum Junction Temperature	T_J(max)		165	ºC
Storage Temperature	T_{stg}		–65 to 170	ºC

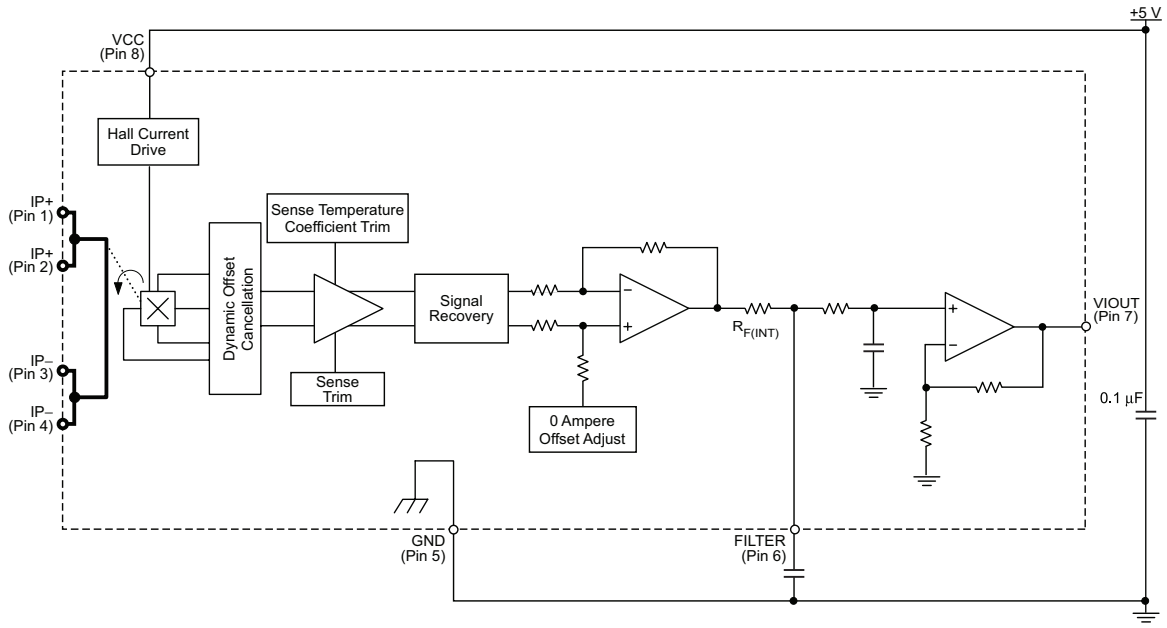
Isolation Characteristics

Characteristic	Symbol	Notes	Rating	Unit
Dielectric Strength Test Voltage*	V_{ISO}	Agency type-tested for 60 seconds per UL standard 60950-1, 1st Edition	2100	VAC
Working Voltage for Basic Isolation	V_{WFSI}	For basic (single) isolation per UL standard 60950-1, 1st Edition	354	VDC or V_{pk}
Working Voltage for Reinforced Isolation	V_{WFRI}	For reinforced (double) isolation per UL standard 60950-1, 1st Edition	184	VDC or V_{pk}

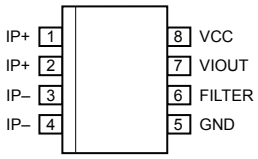
* Allegro does not conduct 60-second testing. It is done only during the UL certification process.

Parameter	Specification
Fire and Electric Shock	CAN/CSA-C22.2 No. 60950-1-03 UL 60950-1:2003 EN 60950-1:2001

Functional Block Diagram



Pin-out Diagram



Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sampled; fused internally
3 and 4	IP–	Terminals for current being sampled; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

COMMON OPERATING CHARACTERISTICS[1] over full range of T_A, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
ELECTRICAL CHARACTERISTICS						
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Supply Current	I_{CC}	V_{CC} = 5.0 V, output open	–	10	13	mA
Output Capacitance Load	C_{LOAD}	VIOUT to GND	–	–	10	nF
Output Resistive Load	R_{LOAD}	VIOUT to GND	4.7	–	–	kΩ
Primary Conductor Resistance	$R_{PRIMARY}$	T_A = 25°C	–	1.2	–	mΩ
Rise Time	t_r	$I_P = I_P$(max), T_A = 25°C, C_{OUT} = open	–	3.5	–	µs
Frequency Bandwidth	f	–3 dB, T_A = 25°C; I_P is 10 A peak-to-peak	–	80	–	kHz
Nonlinearity	E_{LIN}	Over full range of I_P	–	1.5	–	%
Symmetry	E_{SYM}	Over full range of I_P	98	100	102	%
Zero Current Output Voltage	$V_{IOUT(Q)}$	Bidirectional; I_P = 0 A, T_A = 25°C	–	V_{CC} × 0.5	–	V
Power-On Time	t_{PO}	Output reaches 90% of steady-state level, T_J = 25°C, 20 A present on leadframe	–	35	–	µs
Magnetic Coupling[2]			–	12	–	G/A
Internal Filter Resistance[3]	$R_{F(INT)}$			1.7		kΩ

[1]Device may be operated at higher primary current levels, I_P, and ambient, T_A, and internal leadframe temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

[2]1G = 0.1 mT.

[3]$R_{F(INT)}$ forms an RC circuit via the FILTER pin.

COMMON THERMAL CHARACTERISTICS[1]

			Min.	Typ.	Max.	Units
Operating Internal Leadframe Temperature	T_A	E range	–40	–	85	°C
					Value	Units
Junction-to-Lead Thermal Resistance[2]	$R_{\theta JL}$	Mounted on the Allegro ASEK 712 evaluation board			5	°C/W
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	Mounted on the Allegro 85-0322 evaluation board, includes the power consumed by the board			23	°C/W

[1]Additional thermal information is available on the Allegro website.

[2]The Allegro evaluation board has 1500 mm^2 of 2 oz. copper on each side, connected to pins 1 and 2, and to pins 3 and 4, with thermal vias connecting the layers. Performance values include the power consumed by the PCB. Further details on the board are available from the Frequently Asked Questions document on our website. Further information about board design and thermal performance also can be found in the Applications Information section of this datasheet.

x05B PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–5	–	5	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	180	185	190	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 185 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	21	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.26	–	mV/°C
		T_A = 25°C to 150°C	–	–0.08	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.054	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.008	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P =±5 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, $T_{J(max)}$, is not exceeded.

[2]Percentage of I_P, with I_P = 5 A. Output filtered.

x20A PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–20	–	20	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	96	100	104	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 100 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	11	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.34	–	mV/°C
		T_A = 25°C to 150°C	–	–0.07	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.017	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.004	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P =±20 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

[2]Percentage of I_P, with I_P = 20 A. Output filtered.

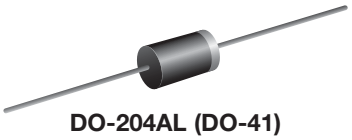
x30A PERFORMANCE CHARACTERISTICS[1] T_A = –40°C to 85°C, C_F = 1 nF, and V_{CC} = 5 V, unless otherwise specified

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Optimized Accuracy Range	I_P		–30	–	30	A
Sensitivity	Sens	Over full range of I_P, T_A = 25°C	63	66	69	mV/A
Noise	$V_{NOISE(PP)}$	Peak-to-peak, T_A = 25°C, 66 mV/A programmed Sensitivity, C_F = 47 nF, C_{OUT} = open, 2 kHz bandwidth	–	7	–	mV
Zero Current Output Slope	$\Delta V_{OUT(Q)}$	T_A = –40°C to 25°C	–	–0.35	–	mV/°C
		T_A = 25°C to 150°C	–	–0.08	–	mV/°C
Sensitivity Slope	ΔSens	T_A = –40°C to 25°C	–	0.007	–	mV/A/°C
		T_A = 25°C to 150°C	–	–0.002	–	mV/A/°C
Total Output Error[2]	E_{TOT}	I_P = ±30 A, T_A = 25°C	–	±1.5	–	%

[1]Device may be operated at higher primary current levels, I_P, and ambient temperatures, T_A, provided that the Maximum Junction Temperature, T_J(max), is not exceeded.

[2]Percentage of I_P, with I_P = 30 A. Output filtered.

General Purpose Plastic Rectifier



DO-204AL (DO-41)

FEATURES

- Low forward voltage drop
- Low leakage current
- High forward surge capability
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb e3 RoHS COMPLIANT

TYPICAL APPLICATIONS

For use in general purpose rectification of power supplies, inverters, converters and freewheeling diodes application.

Note

- These devices are not AEC-Q101 qualified.

MECHANICAL DATA

Case: DO-204AL, molded epoxy body
Molding compound meets UL 94 V-0 flammability rating
Base P/N-E3 - RoHS compliant, commercial grade

Terminals: Matte tin plated leads, solderable per J-STD-002 and JESD 22-B102
E3 suffix meets JESD 201 class 1A whisker test

Polarity: Color band denotes cathode end

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	1.0 A
V_{RRM}	50 V to 1000 V
I_{FSM} (8.3 ms sine-wave)	30 A
I_{FSM} (square wave t_p = 1 ms)	45 A
V_F	1.1 V
I_R	5.0 µA
T_J max.	150 °C

MAXIMUM RATINGS (T_A = 25 °C unless otherwise noted)

PARAMETER		SYMBOL	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007	UNIT
Maximum repetitive peak reverse voltage		V_{RRM}	50	100	200	400	600	800	1000	V
Maximum RMS voltage		V_{RMS}	35	70	140	280	420	560	700	V
Maximum DC blocking voltage		V_{DC}	50	100	200	400	600	800	1000	V
Maximum average forward rectified current 0.375" (9.5 mm) lead length at T_A = 75 °C		$I_{F(AV)}$	1.0							A
Peak forward surge current 8.3 ms single half sine-wave superimposed on rated load		I_{FSM}	30							A
Non-repetitive peak forward surge current square waveform T_A = 25 °C (fig. 3)	t_p = 1 ms	I_{FSM}	45							A
	t_p = 2 ms		35							
	t_p = 5 ms		30							
Maximum full load reverse current, full cycle average 0.375" (9.5 mm) lead length T_L = 75 °C		$I_{R(AV)}$	30							µA
Rating for fusing (t < 8.3 ms)		I^2t (1)	3.7							A^2s
Operating junction and storage temperature range		T_J, T_{STG}	- 50 to + 150							°C

Note

(1) For device using on bridge rectifier appliaction

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

ELECTRICAL CHARACTERISTICS (T_A = 25 °C unless otherwise noted)											
PARAMETER	**TEST CONDITIONS**		**SYMBOL**	**1N4001**	**1N4002**	**1N4003**	**1N4004**	**1N4005**	**1N4006**	**1N4007**	**UNIT**
Maximum instantaneous forward voltage	1.0 A		V_F	1.1							V
Maximum DC reverse current at rated DC blocking voltage		T_A = 25 °C	I_R	5.0							μA
		T_A = 125 °C		50							
Typical junction capacitance	4.0 V, 1 MHz		C_J	15							pF

THERMAL CHARACTERISTICS (T_A = 25 °C unless otherwise noted)									
PARAMETER	**SYMBOL**	**1N4001**	**1N4002**	**1N4003**	**1N4004**	**1N4005**	**1N4006**	**1N4007**	**UNIT**
Typical thermal resistance	$R_{\theta JA}$ (1)	50							°C/W
	$R_{\theta JL}$ (1)	25							

Note

(1) Thermal resistance from junction to ambient at 0.375" (9.5 mm) lead length, PCB mounted

ORDERING INFORMATION (Example)				
PREFERRED P/N	**UNIT WEIGHT (g)**	**PREFERRED PACKAGE CODE**	**BASE QUANTITY**	**DELIVERY MODE**
1N4004-E3/54	0.33	54	5500	13" diameter paper tape and reel
1N4004-E3/73	0.33	73	3000	Ammo pack packaging

RATINGS AND CHARACTERISTICS CURVES

(T_A = 25 °C unless otherwise noted)

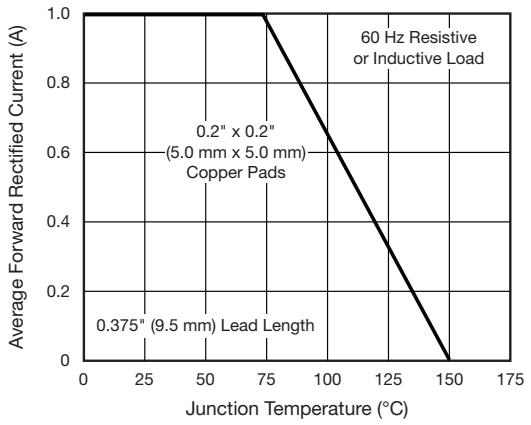


Fig. 1 - Forward Current Derating Curve

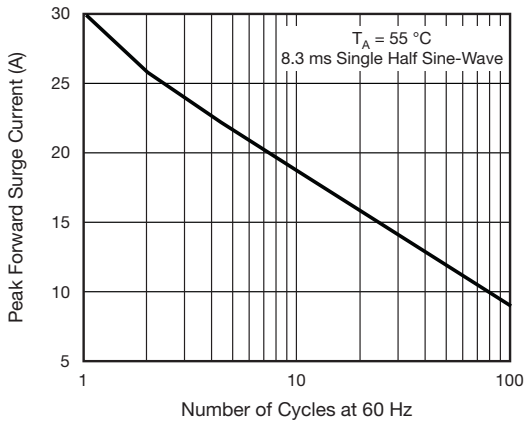
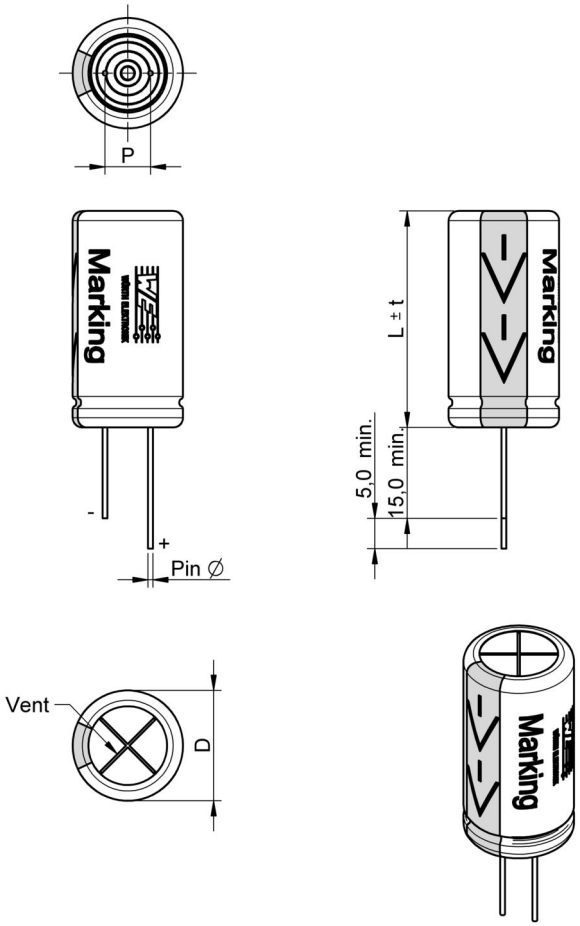


Fig. 2 - Maximum Non-repetitive Peak Forward Surge Current

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

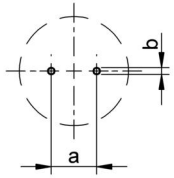
Document Number: 88503
Revision: 23-Feb-11

A Dimensions: [mm]

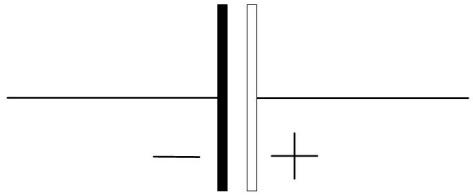


D ±0.5	5.0
P ±0.5	2.0
L ±t	11.0
t	1.5
Pin Ø ±0.02	0.5
a	2.0
b	0.8

B Recommended hole pattern: [mm]



C Schematic:



WÜRTH ELEKTRONIK

D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	0.1	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	3	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	120Hz @85°C	I_{ripple}	3.3	mA	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-40 °C bis +85 °C
Load Life:	2000 h @ +85°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

1.0	2014-11-11	SSt	PSL
REV	DATE	BY	CHECKED

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
www.we-online.com
eiSos@we-online.com

DESCRIPTION

WCAP-ATG8 Aluminum Electrolytic Capacitors

Order.- No.

860010672001

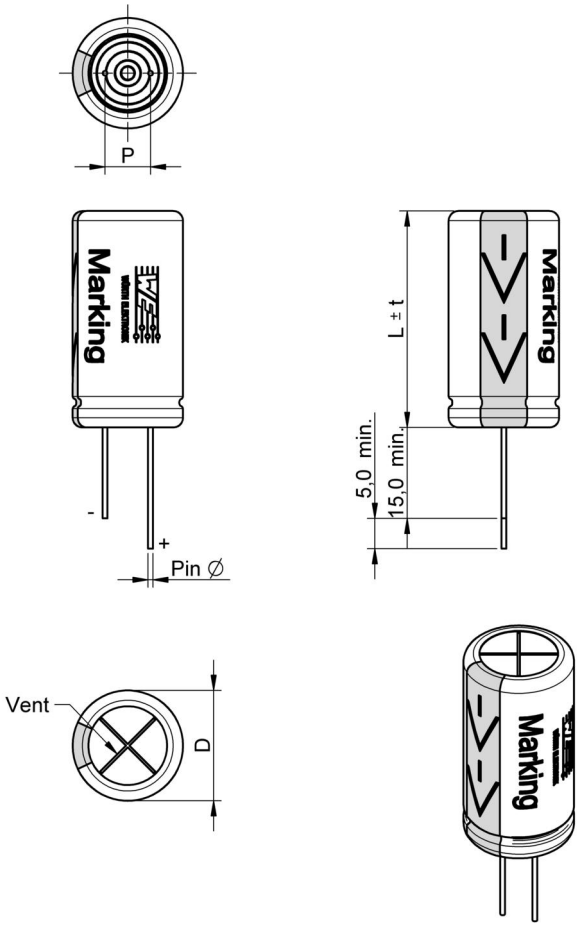
COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE

A4

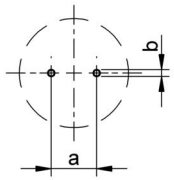
Size: 5.0 x 11.0

A Dimensions: [mm]

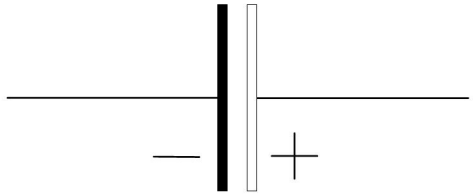


D ±0.5	5.0
P ±0.5	2.0
L ±t	11.0
t	1.5
Pin Ø ±0.02	0.5
a	2.0
b	0.8

B Recommended hole pattern: [mm]



C Schematic:



WÜRTH ELEKTRONIK

D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	1.0	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	3.0	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	100kHz @105°C	I_{ripple}	24	mA	max.
Impedance	100kHz @20°C	Z	4.31	Ω	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-55 °C up to +105 °C
Load Life:	4000 h @ +105°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

REV	DATE	BY	CHECKED
1.0	2014-11-11	SSt	PSL

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
www.we-online.com
eiSos@we-online.com

DESCRIPTION

WCAP-ATLL Aluminum Electrolytic Capacitors

Order.- No.

860160672002

COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE

A4

Size: 5.0 x 11.0

1N53 Series

5 Watt Surmetic™ 40 Zener Voltage Regulators

This is a complete series of 5 Watt Zener diodes with tight limits and better operating characteristics that reflect the superior capabilities of silicon−oxide passivated junctions. All this in an axial lead, transfer−molded plastic package that offers protection in all common environmental conditions.

Features

- Zener Voltage Range − 3.3 V to 200 V
- ESD Rating of Class 3 (>16 kV) per Human Body Model
- Surge Rating of up to 180 W @ 8.3 ms
- Maximum Limits Guaranteed on up to Six Electrical Parameters
- Pb−Free Packages are Available*

Mechanical Characteristics

CASE: Void free, transfer−molded, thermosetting plastic
FINISH: All external surfaces are corrosion resistant and leads are readily solderable
MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 260°C, 1/16 in. from the case for 10 seconds
POLARITY: Cathode indicated by polarity band
MOUNTING POSITION: Any

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Max. Steady State Power Dissipation @ T_L = 25°C, Lead Length = 3/8 in	P_D	5	W
Derate above 25°C		40	mW/°C
Junction−to−Lead Thermal Resistance	θ_{JL}	25	°C/W
Operating and Storage Temperature Range	T_J, T_{stg}	−65 to +200 (Note 1)	°C

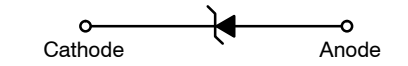
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

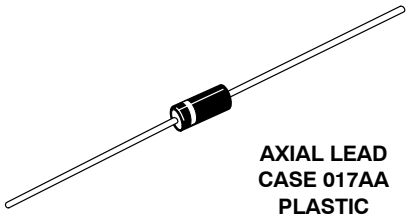
1. Max operating temperature for DC conditions is 150°C, but not to exceed 200°C for pulsed conditions with low duty cycle or non−repetitive.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor®

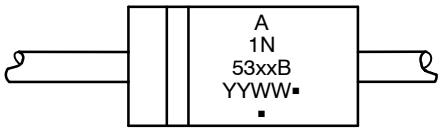
http://onsemi.com





AXIAL LEAD
CASE 017AA
PLASTIC

MARKING DIAGRAM



A	=	Assembly Location
1N53xxB	=	Device Number (Refer to Tables on Pages 3 & 4)
YY	=	Year
WW	=	Work Week
▪	=	Pb−Free Package

(Note: Microdot may be in either location)

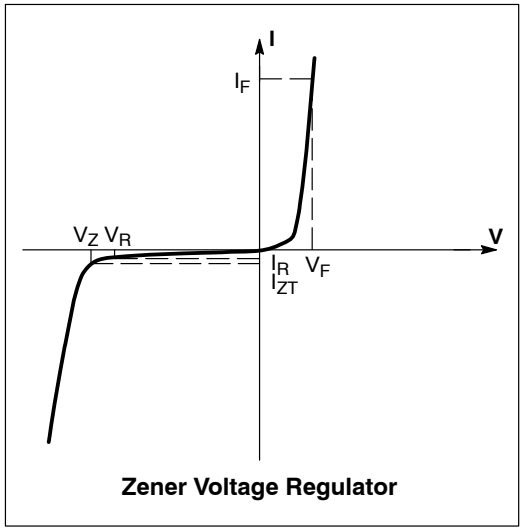
ORDERING INFORMATION

Device	Package	Shipping†
1N53xxB, G	Axial Lead (Pb−Free)	1000 Units/Box
1N53xxBRL, G	Axial Lead (Pb−Free)	4000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.2 V Max @ I_F = 1.0 A for all types)

Symbol	Parameter
V_Z	Reverse Zener Voltage @ I_{ZT}
I_{ZT}	Reverse Current
Z_{ZT}	Maximum Zener Impedance @ I_{ZT}
I_{ZK}	Reverse Current
Z_{ZK}	Maximum Zener Impedance @ I_{ZK}
I_R	Reverse Leakage Current @ V_R
V_R	Breakdown Voltage
I_F	Forward Current
V_F	Forward Voltage @ I_F
I_R	Maximum Surge Current @ T_A = 25°C
ΔV_Z	Reverse Zener Voltage Change
I_{ZM}	Maximum DC Zener Current



Zener Voltage Regulator

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.2 V Max @ I_F = 1.0 A for all types)

Device† (Note 2)	Device Marking	Zener Voltage (Note 3) V_Z (Volts) Min	Nom	Max	@ I_{ZT} mA	Zener Impedance (Note 3) Z_{ZT} @ I_{ZT} Ω	Z_{ZK} @ I_{ZK} Ω	I_{ZK} mA	Leakage Current I_R @ V_R μA Max	Volts	I_R (Note 4) A	ΔV_Z (Note 5) Volts	I_{ZM} (Note 6) mA
1N5333B	***1N5333B***	***3.14***	***3.3***	***3.47***	***380***	***3***	***400***	***1***	***300***	***1***	***20***	***0.85***	***1440***
1N5334B	1N5334B	3.42	3.6	3.78	350	2.5	500	1	150	1	18.7	0.8	1320
1N5335B	1N5335B	3.71	3.9	4.10	320	2	500	1	50	1	17.6	0.54	1220
1N5336B	1N5336B	4.09	4.3	4.52	290	2	500	1	10	1	16.4	0.49	1100
1N5337B	***1N5337B***	***4.47***	***4.7***	***4.94***	***260***	***2***	***450***	***1***	***5***	***1***	***15.3***	***0.44***	***1010***
1N5338B	***1N5338B***	***4.85***	***5.1***	***5.36***	***240***	***1.5***	***400***	***1***	***1***	***1***	***14.4***	***0.39***	***930***
1N5339B	***1N5339B***	***5.32***	***5.6***	***5.88***	***220***	***1***	***400***	***1***	***1***	***2***	***13.4***	***0.25***	***865***
1N5340B	1N5340B	5.70	6.0	6.30	200	1	300	1	1	3	12.7	0.19	790
1N5341B	***1N5341B***	***5.89***	***6.2***	***6.51***	***200***	***1***	***200***	***1***	***1***	***3***	***12.4***	***0.1***	***765***
1N5342B	***1N5342B***	***6.46***	***6.8***	***7.14***	***175***	***1***	***200***	***1***	***10***	***5.2***	***11.5***	***0.15***	***700***
1N5343B	1N5343B	7.13	7.5	7.88	175	1.5	200	1	10	5.7	10.7	0.15	630
1N5344B	1N5344B	7.79	8.2	8.61	150	1.5	200	1	10	6.2	10	0.2	580
1N5345B	1N5345B	8.27	8.7	9.14	150	2	200	1	10	6.6	9.5	0.2	545
1N5346B	1N5346B	8.65	9.1	9.56	150	2	150	1	7.5	6.9	9.2	0.22	520
1N5347B	***1N5347B***	***9.50***	***10***	***10.5***	***125***	***2***	***125***	***1***	***5***	***7.6***	***8.6***	***0.22***	***475***

Devices listed in ***bold, italic*** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

2. **TOLERANCE AND TYPE NUMBER DESIGNATION:** The JEDEC type numbers shown indicate a tolerance of ±5%.
3. **ZENER VOLTAGE (V_Z) and IMPEDANCE (I_{ZT} and I_{ZK}):** Test conditions for zener voltage and impedance are as follows: I_Z is applied 40 ±10 ms prior to reading. Mounting contacts are located 3/8″ to 1/2″ from the inside edge of mounting clips to the body of the diode (T_A = 25°C +8°C, −2°C).
4. **SURGE CURRENT (I_R):** Surge current is specified as the maximum allowable peak, non−recurrent square−wave current with a pulse width, PW, of 8.3 ms. The data given in Figure 5 may be used to find the maximum surge current for a square wave of any pulse width between 1 ms and 1000 ms by plotting the applicable points on logarithmic paper. Examples of this, using the 3.3 V and 200 V zener are shown in Figure 6. Mounting contact located as specified in Note 2 (T_A = 25°C +8°C, −2°C).
5. **VOLTAGE REGULATION (ΔV_Z):** The conditions for voltage regulation are as follows: V_Z measurements are made at 10% and then at 50% of the I_Z max value listed in the electrical characteristics table. The test current time duration for each V_Z measurement is 40 ±10 ms. Mounting contact located as specified in Note 2 (T_A = 25°C +8°C, −2°C).
6. **MAXIMUM REGULATOR CURRENT (I_{ZM}):** The maximum current shown is based on the maximum voltage of a 5% type unit, therefore, it applies only to the B−suffix device. The actual I_{ZM} for any device may not exceed the value of 5 watts divided by the actual V_Z of the device. T_L = 25°C at 3/8″ maximum from the device body.

†The “G” suffix indicates Pb−Free package or Pb−Free packages are available.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.2 V Max @ I_F = 1.0 A for all types)

Device† (Note 7)	Device Marking	Zener Voltage (Note 8)				Zener Impedance (Note 8)			Leakage Current		I_R (Note 9)	ΔV_Z (Note 10)	I_{ZM} (Note 11)
		V_Z (Volts)			@ I_{ZT}	Z_{ZT} @ I_{ZT}	Z_{ZK} @ I_{ZK}	I_{ZK}	I_R @ V_R				
		Min	Nom	Max	mA	Ω	Ω	mA	μA Max	Volts	A	Volts	mA
1N5348B	1N5348B	10.45	11	11.55	125	2.5	125	1	5	8.4	8.0	0.25	430
1N5349B	***1N5349B***	***11.4***	***12***	***12.6***	***100***	***2.5***	***125***	***1***	***2***	***9.1***	***7.5***	***0.25***	***395***
1N5350B	***1N5350B***	***12.35***	***13***	***13.65***	***100***	***2.5***	***100***	***1***	***1***	***9.9***	***7.0***	***0.25***	***365***
1N5351B	1N5351B	13.3	14	14.7	100	2.5	75	1	1	10.6	6.7	0.25	340
1N5352B	***1N5352B***	***14.25***	***15***	***15.75***	***75***	***2.5***	***75***	***1***	***1***	***11.5***	***6.3***	***0.25***	***315***
1N5353B	***1N5353B***	***15.2***	***16***	***16.8***	***75***	***2.5***	***75***	***1***	***1***	***12.2***	***6.0***	***0.3***	***295***
1N5354B	1N5354B	16.15	17	17.85	70	2.5	75	1	0.5	12.9	5.8	0.35	280
1N5355B	1N5355B	17.1	18	18.9	65	2.5	75	1	0.5	13.7	5.5	0.4	264
1N5356B	1N5356B	18.05	19	19.95	65	3	75	1	0.5	14.4	5.3	0.4	250
1N5357B	1N5357B	19	20	21	65	3	75	1	0.5	15.2	5.1	0.4	237
1N5358B	***1N5358B***	***20.9***	***22***	***23.1***	***50***	***3.5***	***75***	***1***	***0.5***	***16.7***	***4.7***	***0.45***	***216***
1N5359B	***1N5359B***	***22.8***	***24***	***25.2***	***50***	***3.5***	***100***	***1***	***0.5***	***18.2***	***4.4***	***0.55***	***198***
1N5360B	1N5360B	23.75	25	26.25	50	4	110	1	0.5	19	4.3	0.55	190
1N5361B	***1N5361B***	***25.65***	***27***	***28.35***	***50***	***5***	***120***	***1***	***0.5***	***20.6***	***4.1***	***0.6***	***176***
1N5362B	1N5362B	26.6	28	29.4	50	6	130	1	0.5	21.2	3.9	0.6	170
1N5363B	1N5363B	28.5	30	31.5	40	8	140	1	0.5	22.8	3.7	0.6	158
1N5364B	1N5364B	31.35	33	34.65	40	10	150	1	0.5	25.1	3.5	0.6	144
1N5365B	***1N5365B***	***34.2***	***36***	***37.8***	***30***	***11***	***160***	***1***	***0.5***	***27.4***	***3.5***	***0.65***	***132***
1N5366B	1N5366B	37.05	39	40.95	30	14	170	1	0.5	29.7	3.1	0.65	122
1N5367B	1N5367B	40.85	43	45.15	30	20	190	1	0.5	32.7	2.8	0.7	110
1N5368B	***1N5368B***	***44.65***	***47***	***49.35***	***25***	***25***	***210***	***1***	***0.5***	***35.8***	***2.7***	***0.8***	***100***
1N5369B	1N5369B	48.45	51	53.55	25	27	230	1	0.5	38.8	2.5	0.9	93
1N5370B	1N5370B	53.2	56	58.8	20	35	280	1	0.5	42.6	2.3	1.0	86
1N5371B	1N5371B	57	60	63	20	40	350	1	0.5	45.5	2.2	1.2	79
1N5372B	1N5372B	58.9	62	65.1	20	42	400	1	0.5	47.1	2.1	1.35	76
1N5373B	1N5373B	64.6	68	71.4	20	44	500	1	0.5	51.7	2.0	1.52	70
1N5374B	1N5374B	71.25	75	78.75	20	45	620	1	0.5	56	1.9	1.6	63
1N5375B	1N5375B	77.9	82	86.1	15	65	720	1	0.5	62.2	1.8	1.8	58
1N5377B	1N5377B	86.45	91	95.55	15	75	760	1	0.5	69.2	1.6	2.2	52.5
1N5378B	1N5378B	95	100	105	12	90	800	1	0.5	76	1.5	2.5	47.5
1N5380B	1N5380B	114	120	126	10	170	1150	1	0.5	91.2	1.3	2.5	39.5
1N5381B	1N5381B	123.5	130	136.5	10	190	1250	1	0.5	98.8	1.2	2.5	36.6
1N5383B	***1N5383B***	***142.5***	***150***	***157.5***	***8***	***330***	***1500***	***1***	***0.5***	***114***	***1.1***	***3.0***	***31.6***
1N5384B	1N5384B	152	160	168	8	350	1650	1	0.5	122	1.1	3.0	29.4
1N5386B	1N5386B	171	180	189	5	430	1750	1	0.5	137	1.0	4.0	26.4
1N5387B	1N5387B	180.5	190	199.5	5	450	1850	1	0.5	144	0.9	5.0	25
1N5388B	1N5388B	190	200	210	5	480	1850	1	0.5	152	0.9	5.0	23.6

Devices listed in ***bold, italic*** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

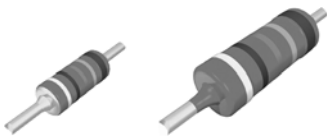
7. **TOLERANCE AND TYPE NUMBER DESIGNATION:** The JEDEC type numbers shown indicate a tolerance of ±5%.
8. **ZENER VOLTAGE (V_Z) and IMPEDANCE (I_{ZT} and I_{ZK}):** Test conditions for zener voltage and impedance are as follows: I_Z is applied 40 ±10 ms prior to reading. Mounting contacts are located 3/8″ to 1/2″ from the inside edge of mounting clips to the body of the diode (T_A = 25°C +8°C, −2°C).
9. **SURGE CURRENT (I_R):** Surge current is specified as the maximum allowable peak, non−recurrent square−wave current with a pulse width, PW, of 8.3 ms. The data given in Figure 5 may be used to find the maximum surge current for a square wave of any pulse width between 1 ms and 1000 ms by plotting the applicable points on logarithmic paper. Examples of this, using the 3.3 V and 200 V zener are shown in Figure 6. Mounting contact located as specified in Note 7 (T_A = 25°C +8°C, −2°C).
10. **VOLTAGE REGULATION (ΔV_Z):** The conditions for voltage regulation are as follows: V_Z measurements are made at 10% and then at 50% of the I_Z max value listed in the electrical characteristics table. The test current time duration for each V_Z measurement is 40 ±10 ms. Mounting contact located as specified in Note 7 (T_A = 25°C +8°C, −2°C).
11. **MAXIMUM REGULATOR CURRENT (I_{ZM}):** The maximum current shown is based on the maximum voltage of a 5% type unit, therefore, it applies only to the B−suffix device. The actual I_{ZM} for any device may not exceed the value of 5 watts divided by the actual V_Z of the device. T_L = 25°C at 3/8″ maximum from the device body.

†The “G” suffix indicates Pb−Free package or Pb−Free packages are available.

MRS16, MRS25

Vishay BCcomponents

Professional Thin Film Leaded Resistors



FEATURES

- Technology: Metal film
- Professional resistors in small outlines
- Low noise
- Lead (Pb)-free solder contacts
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compatible to RoHS Directive 2002/95/EC

Pb-free RoHS COMPLIANT

APPLICATIONS

- All general purpose applications

DESCRIPTION

A homogeneous film of metal alloy is deposited on a high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting wires of electrolytic copper are welded to the end-caps. The resistors are coated with lacquer which provides electrical, mechanical, and climatic protection. Four or five color code rings designate the resistance value and tolerance according to **IEC 60062**. Suitable replacements for MRS16 and MRS25 are MBA/SMA 0204 and MBB/SMA 0207 professional.

TECHNICAL SPECIFICATIONS

DESCRIPTION	UNIT	MRS16	MRS25
Resistance Range	Ω	4.99 to 1M	1 to 10M
Resistance Tolerance	%	± 1	± 1
Resistance Series		E24, E96	E24, E96
Rated Dissipation, P_{70}	W	0.4	0.6
Thermal Resistance (R_{th})	K/W	170	150
Temperature Coefficient	ppm/K	± 50	± 50
Operating Voltage, $U_{max.}$ AC/DC	V	200	350
Basic Specifications		IEC 60 115-1	IEC 60 115-1
Climatic Category (IEC 60068-1)		55/155/56	55/155/56
Max. Resistance Change for Resistance Range, ΔR max., after:			
Load (1000 h, P_{70})		± (0.5 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)
Long Term Damp Heat Test (56 Days):			
MRS16: 4.99 Ω ≤ R ≤ 332 kΩ; MRS25: 1 Ω ≤ R ≤ 1 MΩ		± (0.5 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)
MRS16: R > 332 kΩ; MRS25: R > 1 MΩ		± (2 % R + 0.05 Ω)	± (2 % R + 0.05 Ω)
Soldering (260 °C, 10 s):			
MRS16: 4.99 Ω ≤ R ≤ 332 kΩ; MRS25: 1 Ω ≤ R ≤ 1 MΩ		± (0.1 % R + 0.05 Ω)	± (0.1 % R + 0.05 Ω)
MRS16: R > 332 kΩ; MRS25: R > 1 MΩ		± (0.5 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)
Short Time Overload:			
MRS16: 4.99 Ω ≤ R ≤ 332 kΩ; MRS25: 1 Ω ≤ R ≤ 1 MΩ		± (0.1 % R + 0.01 Ω)	± (0.1 % R + 0.01 Ω)
MRS16: R > 332 kΩ; MRS25; R > 1 MΩ		± (0.5 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)

PACKAGING

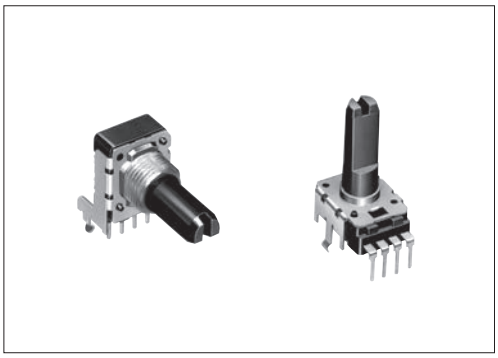
MODEL	REEL		BOX	
	PIECES/REEL	CODE	PIECES/BOX	CODE
MRS16	5000	RP	1000	C1
			5000	CT
MRS25	5000	RP	1000	C1
			5000	CT

For technical questions, contact: filmresistorsleaded@vishay.com

Document Number: 28724
Revision: 17-Aug-11

RK11K 11mm Size Insulated Shaft Snap-in Type

A 11mm wide potentiometer for audio, visual, electronic musical instruments and various applications



Typical Specifications

Items	Specifications
Total resistance tolerance	±20%
Maximum operating voltage	50V AC, 20V DC
Total rotational angle	300°±5°
Rotational torque	3 to 20mN·m
Operating life	15,000 cycles
Operating temperature range	−10℃ to +70℃

Product Line

Number of resistor elements	Mounting direction	Bushing	Shaft type	Length of the shaft LM_1 (mm)	Center detent	Total resistance (kΩ)	Resistance taper	Minimum order unit (pcs.) Japan	Minimum order unit (pcs.) Export	Products No.	Drawing No.
Single-unit (20V DC)	Vertical type	Without	Flat	15	Without	10	1B	1,200	2,400	**RK11K1130A2X**	2
				20				1,000	2,000	**RK11K1130A0M**	
					With					**RK11K1130040**	
				25	Without			800	1,600	**RK11K1130A07**	
					With	20				**RK11K113002F**	
		With		20		10		1,000	2,000	**RK11K114003Y**	4
				22.5	Without					**RK11K1140A9L**	
				25				800	1,600	**RK11K1140A23**	
					With					**RK11K114001Z**	
				27.5	Without					**RK11K1140A3L**	
				30		20				**RK11K1140A4Q**	
				32.5		10				**RK11K1140A2S**	
	Horizontal type	Without		25						**RK11K1110A3D**	1
		With		22.5	With	20		1,000	2,000	**RK11K1120060**	3
				25	Without	10		800	1,600	**RK11K1120A5T**	
				27.5		20	15A			**RK11K1120A31**	

Notes

1. Other varieties are also available. Refer to "Other Specifications" (P.361).
2. Nut and washer are not attached. Please specify if required.

Packing Specifications

Tray

Length of the shaft LM_1 (mm)	Number of packages (pcs.) 1 case / Japan	Number of packages (pcs.) 1 case / export packing	Export package measurements (mm)
15	1,200	2,400	374×532×240
20 to 22.5	1,000	2,000	
25 or more	800	1,600	

Refer to P.361 for other specifications.
Refer to P.362 for ordering products not listed.
Refer to P.371 for soldering conditions.

Insulated Shaft Potentiometers

List of Varieties

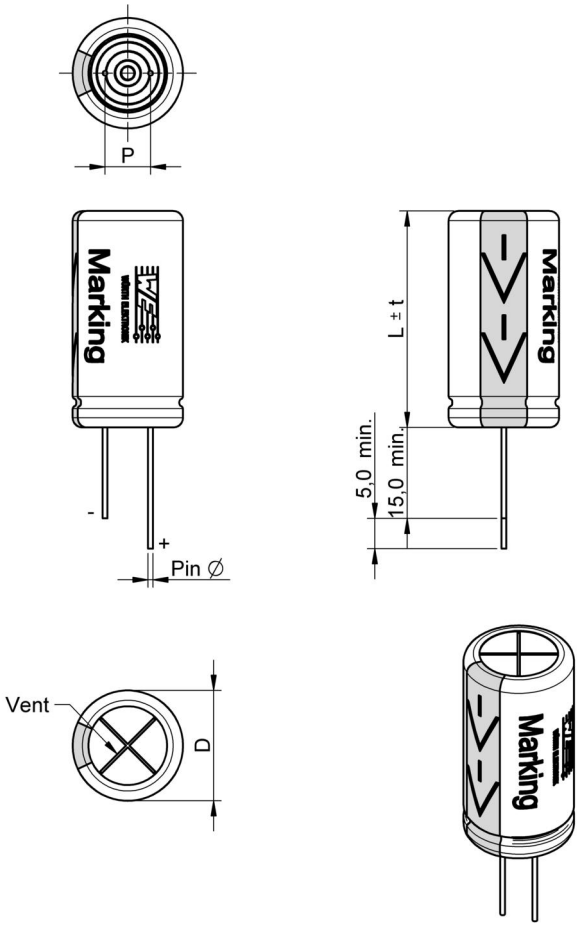
Type		9mm size			11mm size	12mm size		14mm size
Series		RK09K11 RK09D11	RK09K12	RK09Y11L	RK11K	RK12L12	RK12L115	RK14K
		Single-unit	Dual-unit	Single-unit	Single-unit	Dual-unit	Single-unit	Dual-unit
Photo								
Terminal mounting		Vertical / Horizontal		Horizontal	Vertical / Horizontal		Vertical	Vertical / Horizontal
Bushing		Without			With / Without	Without	With	With / Without
Operating temperature range		−10℃ to + 70℃					−40℃ to + 85℃	−10℃ to + 70℃
Operating life		5,000 cycles	10,000 cycles	1,000,000 cycles	15,000 cycles			
Available for automotive use		—	—	—	—	—	●	—
Life cycle		★2		★2	★2	★2	★2	★2
Electrical performance	Total resistance (k Ω)	5, 10, 20, 50, 100, 200		10	5, 10, 20, 50, 100, 200		5, 10, 20, 50, 100	5, 10, 20, 50, 100, 200
	Resistance taper	15A, 1B, 3B, 15C		B	15A, 1B, 3B, 15C		15A, 1B, 3B	15A, 1B, 3B, 15C
	Total resistance tolerance	±20%	±30%	±30%	±20%			
	Rated power	0.05W	0.03W	0.01W	0.05W			
	Maximum operating voltage	50V AC 20V DC	50V AC for AC only	50V AC 5V DC	50V AC 20V DC	50V AC for AC only	50V AC 20V DC	50V AC for AC only
	Gang error	—	−40dB to 0dB 3dB max.	—	—	Volume control −40dB to 0dB 3dB max. For tone control within 2dB at center	—	Volume control −40dB to 0dB 3dB max. For tone control within 2dB at center
	Insulation resistance	100MΩ min. 250V DC			100MΩ min. 500V DC	100MΩ min. 250V DC		
	Voltage proof	250V AC for 1minute			500V AC for 1minute	300V AC for 1minute		
	Center-taps	Without			Without / With	Without		Without / With (Volume control)
Mechanical performance	Detent	Without, Center		Without	Without, Center	Without	Custom	Without, Center
	Stopper strength	0.3N·m		—	Without bushing 0.5N·m With bushing 0.6N·m	0.5N·m		0.6N·m
	Push-pull strength	50N max.		30N max.	80N max.			
	Vibration	10 to 55 to 10Hz/min., the amplitude is 1.5mm for all the frequencies, in the 3 direction of X, Y and Z and for 2 hours respectively						
Shaft configuration		Flat type, Knob type, Screwdriver type		Flat type				
Terminal style		Insertion						
Page		351		358	359	363	366	367

Insulated Shaft Potentiometers Soldering Conditions · · · · · 371
Potentiometers Cautions · · · · · 427
Potentiometers Measurement and Test Methods · · · · · 429
Potentiometers Resistance Taper · · · · · 431

Note

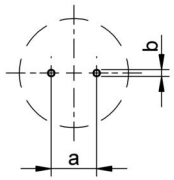
● Indicates applicability to all products in the series.

A Dimensions: [mm]

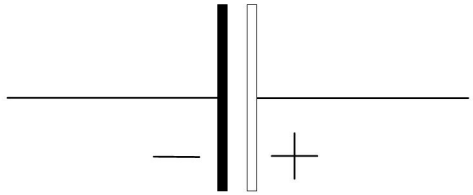


D ±0.5	5.0
P ±0.5	2.0
L ±t	11.0
t	1.5
Pin Ø ±0.02	0.5
a	2.0
b	0.8

B Recommended hole pattern: [mm]



C Schematic:



WÜRTH ELEKTRONIK

D1 Electrical Properties:

Properties	Test conditions		Value	Unit	Tol.
Capacitance	0.25V; 120Hz	C	10	µF	± 20%
Rated voltage		U_R	50	V (DC)	max.
Leakage current	after 2 min.	I_{Leak}	5.0	µA	max.
Dissipation factor	120 Hz	DF	10	%	typ.
Ripple current	100kHz @105°C	I_{ripple}	120	mA	max.
Impedance	100kHz @20°C	Z	2.60	Ω	max.

E General information:

Aluminium Electrolytic Capacitors	
Storage Conditions:	35°C, <45% RH
Operating Temperature:	-55 °C up to +105 °C
Load Life:	4000 h @ +105°C / 50 V (DC)
Test conditions of Electrical Properties:	20°C, 33% RH; if not specified differently
FIT according to	separate documentation

REV	DATE	BY	CHECKED
1.0	2014-11-11	SSt	PSL

Projection

Würth Elektronik eiSos GmbH & Co. KG
EMC & Inductive Solutions
Max-Eyth-Str. 1
74638 Waldenburg
Germany
Tel. +49 (0) 79 42 945 - 0
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eiSos@we-online.com

DESCRIPTION

WCAP-ATLL Aluminum Electrolytic Capacitors

Order.- No.

860160672009

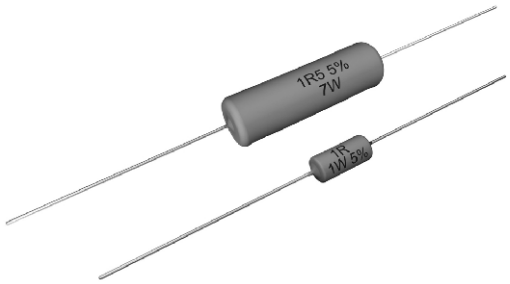
COMPLIANT RoHS&REACh WÜRTH ELEKTRONIK

SIZE

A4

Size: 5.0 x 11.0

Cemented Wirewound Resistors



FEATURES

- All welded construction
- Ceramic core
- Non-flammable cement coating
- Tinned copper-clad iron leads (for axial parts)
- High power dissipation in small volume
- Ideal for pulse application
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	POWER RATING $P_{40\,°C}$ W	POWER RATING $P_{70\,°C}$ W	LIMITING VOLTAGE $U_{max.}$	RESISTANCE RANGE (1) Ω TCR = - 10 ppm/K to - 80 ppm/K	RESISTANCE RANGE (1) Ω TCR = 100 ppm/K to 180 ppm/K	RESISTANCE RANGE (1) Ω TCR= ± 100 ppm/K	TOLERANCE ± %
AC01	1	0.9	$\sqrt{P \times R}$	0.10 to 33	36 to 2.4K	n/a	5
AC03 (2)	3	2.5	$\sqrt{P \times R}$	0.10 to 390	430 to 3.3K	3.6K to 5.1K	5
AC04	4	3.5	$\sqrt{P \times R}$	0.10 to 620	680 to 6.8K	n/a	5
AC05	5	4.7	$\sqrt{P \times R}$	0.10 to 910	1K to 10K	n/a	5
AC07	7	5.8	$\sqrt{P \times R}$	0.10 to 1.5K	1.6K to 15K	n/a	5
AC10	10	8.4	$\sqrt{P \times R}$	0.22 to 560	620 to 27K	n/a	5

Notes
(1) Resistance value to be selected for ± 5 % from E24
(2) AC03 WSZ: $P_{40\,°C}$ = 1.8 W; $P_{70\,°C}$ = 1.5 W

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: AC03000001509JAC00

A	C	0	3	0	0	0	0	0	1	5	0	9	J	A	C	0	0

MODEL	VARIANT	TCR/MATERIAL	VALUE	TOLERANCE CODE	PACKAGING CODE	SPECIAL
AC01000 = AC01 **AC03000** = AC03 **AC04000** = AC04 **AC05000** = AC05 **AC07000** = AC07 **AC10000** = AC10	**0** = Neutral **1** = RT **2** = SWI = Special winding (3) **3** = DK SP 20 mm (4) **4** = DK LP 33 mm (4) **5** = DK LP 17.8 mm (4) **6** = NI = Non inductive (7) **7** = DK LP 25.4 mm (4) **9** = WSZ 6720 **8** = DK SP 25.4 mm **Z** = Value overflow (Special) **C** = E/K 25.4 mm (4)	**0** = Standard	**3 digit value** **1 digit multiplier** MULTIPLIER **7** = $*10^{-3}$ **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **5** = 10^{-4}	**J** = ± 5.0 %	(See Packaging table)	The 5 digit BV number will be encoded using a 36 character code. This code contains numbers 0...9 and letters A...Z (36 characters total) and allows to encode at least 46 655 five digit BV numbers. **00** = Standard

Product Description: AC03 15R 5 % AC

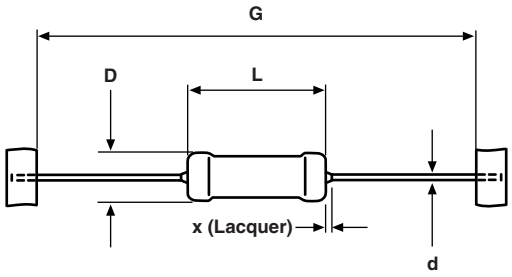
AC03	15R	5 %	AC
MODEL (5)	VALUE (5)	TOLERANCE CODE (5)	PACKAGING DESCRIPTION (6)

Notes
(3) Special winding on request
(4) Other dimensions and variants on request
(5) See “Part Number and Product Description”
(6) See “Packaging Table”
(7) Resistance range on request

For technical questions, contact: ww1resistors@vishay.com

PACKAGING TABLE									
MODEL	AMMO			LOOSE			BLISTER		
	PIECES	PACK. CODE	PACK. DESC.	PIECES	PACK. CODE	PACK. DESC.	PIECES	PACK. CODE	PACK. DESC.
AC01	1000	A1	A1						
AC01 DK/EK				500	LC	LC			
AC01RT	2500	AE	AE						
AC03	500	AC	AC						
AC03 DK/EK				500	LC	LC			
AC03 WSZ							1250	BM	BM
AC04	500	AC	AC						
AC04 DK/EK				500	LC	LC			
AC05	500	AC	AC						
AC05 DK/EK				500	LC	LC			
AC07	500	AC	AC						
AC07 DK/EK				250	LB	LB			
AC10	250	AB	AB						

DIMENSIONS



For packaging dimensions see: www.vishay.com/doc?28721

DIMENSIONS - Resistor types, mass and relevant physical dimensions						
MODEL	DIMENSIONS in millimeters [inches]					
	$D_{max.}$	$L_{max.}$	d	$x_{max.}$	G	WEIGHT g PER UNIT
AC01	4.3 [0.169]	11 [0.433]	0.8 ± 0.03 [0.031 ± 0.001]	2	63 ± 1 [2.480 ± 0.039]	0.52
AC03	4.8 [0.189]	13 [0.512]		2	63 ± 1 [2.480 ± 0.039]	0.75
AC04	5.5 [0.217]	16.5 [0.650]		3	63 ± 1 [2.480 ± 0.039]	1.10
AC05	7.5 [0.295]	18 [0.709]		3	63 ± 1 [2.480 ± 0.039]	1.90
AC07	7.5 [0.295]	26 [1.024]		3	73 ± 1 [2.874 ± 0.039]	2.60
AC10	8.0 [0.315]	44 [1.732]		3	88 ± 1 [3.465 ± 0.039]	4.50

Type CFR Series

Key Features

- Low cost, combined with high reliability, make these components suitable for use in most types of circuits, including audio, communications, measurement and computer applications.
- Premium quality carbon film resistors whose ceramic core has a high alumina content offering power to size ratios not normally associated with carbon film product.
- Available in 5 power ratings from 1 ohm to 10 Mohm. The smallest case size (CFR16) has a full 0.25 W power rating.

The resistive element comprises a thin film of carbon, deposited onto a high thermal conductivity ceramic core. Metal end caps are force fitted to the element prior to spiralling to value. Tinned copper lead wires are welded to the end caps and the components are then coated. One coat of phenolic resin is followed by three coats of epoxy resin. All resistors are tested for value and tolerance.

Characteristics - Electrical

		CFR16	CFR25	CFR50	CFR100	CFR200
Rated Power @ 70 °C (W)		0.25	0.33	0.5	1	2
Resistance Range (Ohms)	Min	1R0	1R0	1R0	1R0	1R0
	Max	4M7	10M	10M	10M	10M
Tolerance (%)				2	5	
Code letter				G	J	
Temp. Coefficient	up to 10R	±350	±350	±350	±350	±350
(ppm/°C)	11R - 99K	0 to -450	0 to -450	0 to -450	0 to -450	0 to -450
	100K - 1M0	0 to -700	0 to -700	0 to -700	0 to -700	0 to -700
	1M1 - 10M	0 to -1500	0 to -1500	0 to -1500	0 to -1500	0 to -1500
Selection Series				E24		
Limiting Element Voltage (V)		200	250	350	500	500
Max Overload Voltage[1] (V)		400	500	700	1000	1000
Max Intermittent Overload Voltage[2] (V)		500	700	750	750	750
Operating Temp. Range (°C)				-55 to +155		
Climatic Category (°C)				55/155/56		
Dielectric Strength (V)		400	500	700	1000	1000
Insulation Resistance (Mohms)				1000		

[1] Maximum Overload Voltage is 2.5 times rated voltage up to the specified voltage for 5 seconds.

[2] Maximum Intermittent Overload Voltage is 4 times rated voltage up to the specified voltage for 1 second ON and 25 seconds OFF. >100R ONLY

Dimensions are in millimeters and inches unless otherwise specified. Values in brackets are standard equivalents.

Dimensions are shown for reference purposes only. Specifications subject to change.

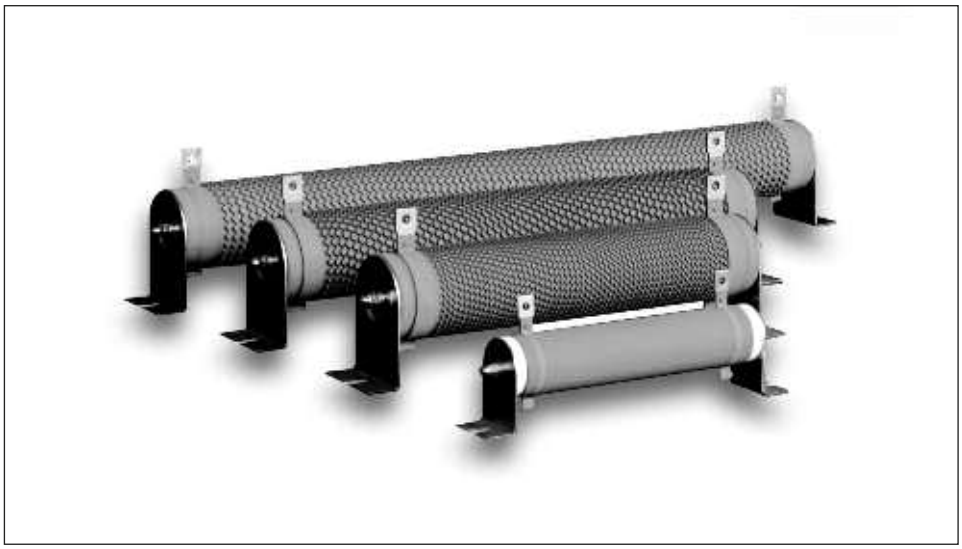
Type TE Series

Key Features

- Mullite Coated
- Up to 2500W Power Rating
- Corrugated Ribbon Element for Rapid Cooling
- 3x Overload for 5 Seconds
- Custom Terminations / Leads Available
- Flameproof Construction

Applications

- Large Electrical and Production Machinery
- Load Test Simulation
- Motor Start/Stop Cycles
- Dynamic Braking
- Equipment Discharge



TE Connectivity is a leading supplier of standard and custom-designed power resistors for industrial, control and general- purpose applications.

The TE range of Mullite coated tubular ceramic core resistors have a corrugated ribbon element for rapid cooling effect to enable up to 2500W power handling capability. Designed for heavy duty machinery, electrical equipment, motor control etc. requiring stability and reliability.

Test Method - Electrical

Test Item	Specification	Test Details
Life (Moisture Load):	40°C 95% RH 1000 hour on-off cycle	ΔR ±3.0%
Short Term Overload:	3 x rated wattage, 5 seconds	-
Flammability:	16x rated power, 5 minutes	No Flames
Insulation Resistance:	DC 500V	Over 100MΩ
Voltage Resistibility:	AC 2500V 1 minute	Free of damage or flying arc
Resistor Strength:	200N, 30 seconds	Free of visible damage
Terminal Strength:	Ual: 45N, 30 seconds	Free of visible damage R ≤ ± (1%R + 0.05Ω)

Dimensions are in millimeters and inches unless otherwise specified. Values in brackets are standard equivalents.

Dimensions are shown for reference purposes only. Specifications subject to change.

Type TE Series

Specifications- Electrical

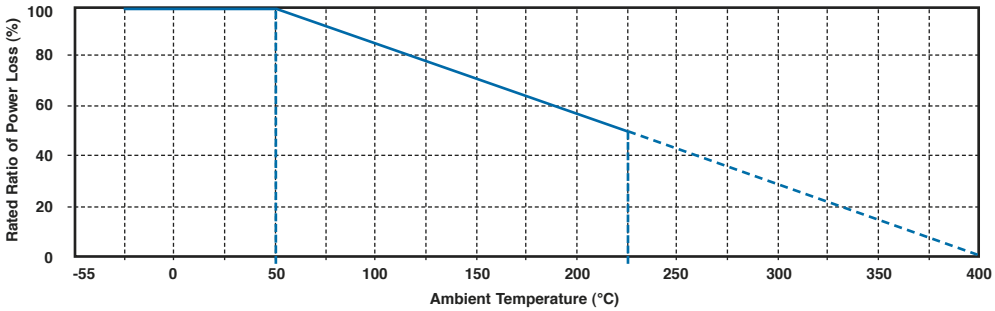
Resistance Range (Ohms)	See Resistance Range Chart below
Selection Series	E12
Tolerance	+/-5%, +/-10% as per Resistance Range Chart below

Type	Resistance Value	Tolerance
50W	R10 – R99	10%
	1R0 – 2K7	5%
60W	R10 – R99	10%
	1R0 – 2K7	5%
80W	R10 – R99	10%
	1R0 – 2K7	5%
100W	1R0 – 2K7	5%
120W	1R0 – 2K7	5%
150W	1R0 – 2K7	5%
200W	1R0 – 2K7	5%
300W	1R0 – 2K7	5%
400W	1R0 – 2K7	5%
500W	1R0 – 2K7	5%
600W	1R0 – 2K7	5%
750W	1R0 – 2K7	5%
1000W	1R0 – 2K7	5%
1200W	1R0 – 2K7	5%
1500W	1R0 – 2K7	5%
2000W	1R0 – 2K7	5%
2500W	1R0 – 2K7	5%

Characteristics - Environmental

Temperature Coefficient of Resistance:	Within ±440ppm/°C
Rated Power Free Air:	50 to 2500 Watts
Operating Temperature Range	-25°C to +225°C

Derating Curve

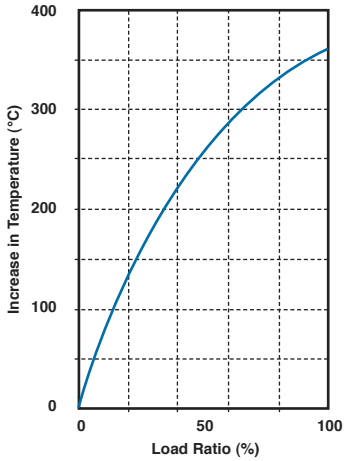


Dimensions are in millimeters and inches unless otherwise specified. Values in brackets are standard equivalents.

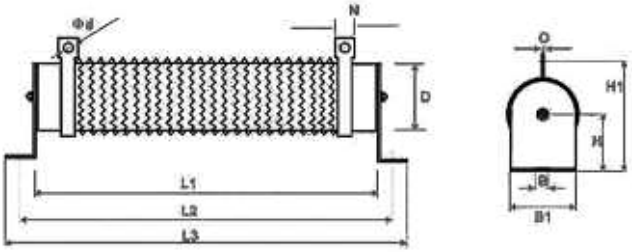
Dimensions are shown for reference purposes only. Specifications subject to change.

Type TE Series

Temperature Rise



Dimensions



Rated Power (W)	Dimensions										
	L1 (±2)	L2 (±5)	L3 (±3)	D (±2)	B	B1	H	H1 (±3)	N	d	O
50	102	124	146	28	6.5	28	28	61	10	4.5	1.2
60	102	124	146	28	6.5	28	28	61	10	4.5	1.2
80	152	174	196	28	6.5	28	28	61	10	4.5	1.2
100	182	204	226	28	6.5	28	28	61	10	4.5	1.2
120	182	204	226	28	6.5	28	28	61	10	4.5	1.2
150	195	217	239	40	8	40	41	81	12	5.5	2.0
200	195	217	239	40	8	40	41	81	12	5.5	2.0
300	282	304	326	40	8	40	41	81	12	5.5	2.0
400	282	304	326	40	8	40	41	81	12	5.5	2.0
500	316	338	360	50	8	50	45	101	16	6	2.0
600	345	367	389	40	8	40	41	81	12	5.5	2.0
750	316	338	360	50	8	50	45	101	16	6	2.0
1000	300	325	350	60	8.5	60	60	119	16	6	2.0
1200	415	440	465	60	8.5	60	60	119	16	6	2.0
1500	415	440	465	60	8.5	60	60	119	16	6	2.0
2000	510	535	560	60	8.5	60	60	119	16	6	2.0
2500	600	625	650	60	8.5	60	60	119	16	6	2.0

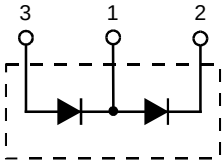
How to Order

TE	50	B	1K0	J
Common Part	**Power Rating**	**Mounting**	**Resistance Value**	**Tolerance**
TE - High Power Wire Wound Resistor	50 - 50 Watt 60 - 60 Watt 80 - 80 Watt 100 - 100 Watt etc.	A - Without Bracket B - With Bracket (Standard)	1 ohm (1000 milliohms) 1R0 10 ohm (10 ohms) 10R 100R ohms (100 ohms) 100R 1k ohms (1000 ohms) 1K0	J - ±5% K - ±10%

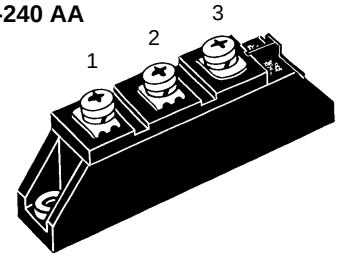
Diode Modules

I_{FRMS} = 2x 60 A
I_{FAVM} = 2x 36 A
V_{RRM} = 800-1800 V

V_{RSM} V	V_{RRM} V	Type
900	800	MDD 26-08N1 B
1300	1200	MDD 26-12N1 B
1500	1400	MDD 26-14N1 B
1700	1600	MDD 26-16N1 B
1900	1800	MDD 26-18N1 B



TO-240 AA



Symbol	Test Conditions		Maximum Ratings	
I_{FRMS}	$T_{VJ} = T_{VJM}$		60	A
I_{FAVM}	T_C = 100°C; 180° sine		36	A
I_{FSM}	T_{VJ} = 45°C;	t = 10 ms (50 Hz), sine	650	A
	V_R = 0	t = 8.3 ms (60 Hz), sine	760	A
	$T_{VJ} = T_{VJM}$	t = 10 ms (50 Hz), sine	580	A
	V_R = 0	t = 8.3 ms (60 Hz), sine	630	A
$\int i^2dt$	T_{VJ} = 45°C	t = 10 ms (50 Hz), sine	2100	A^2s
	V_R = 0	t = 8.3 ms (60 Hz), sine	2400	A^2s
	$T_{VJ} = T_{VJM}$	t = 10 ms (50 Hz), sine	1700	A^2s
	V_R = 0	t = 8.3 ms (60 Hz), sine	1900	A^2s
T_{VJ}			-40...+150	°C
T_{VJM}			150	°C
T_{stg}			-40...+125	°C
V_{ISOL}	50/60 Hz, RMS	t = 1 min	3000	V~
	$I_{ISOL} \leq$ 1 mA	t = 1 s	3600	V~
M_d	Mounting torque (M5)		2.5-4/22-35	Nm/lb.in.
	Terminal connection torque (M5)		2.5-4/22-35	Nm/lb.in.
Weight	Typical including screws		90	g

Symbol	Test Conditions		Characteristic Values	
I_R	$T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$		10	mA
V_F	I_F = 80 A; T_{VJ} = 25°C		1.38	V
V_{T0}	For power-loss calculations only		0.8	V
r_T	$T_{VJ} = T_{VJM}$		6.1	mΩ
Q_S	T_{VJ} = 125°C; I_F = 25 A, -di/dt = 0.6 A/µs		50	µC
I_{RM}			6	A
R_{thJC}	per diode; DC current	other values see Fig. 6/7	1.0	K/W
	per module		0.5	K/W
R_{thJK}	per diode; DC current		1.2	K/W
	per module		0.6	K/W
d_S	Creepage distance on surface		12.7	mm
d_A	Strike distance through air		9.6	mm
a	Maximum allowable acceleration		50	m/s^2

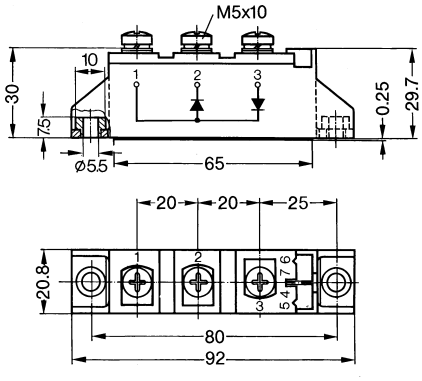
Data according to IEC 60747 and refer to a single diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

Features
- International standard package JEDEC TO-240 AA
- Direct copper bonded Al_2O_3 -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873

Applications
- Supplies for DC power equipment
- DC supply for PWM inverter
- Field supply for DC motors
- Battery DC power supplies

Advantages
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

Dimensions in mm (1 mm = 0.0394")



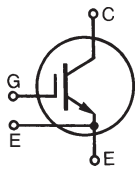
IXYS

GenX3™ 600V IGBT

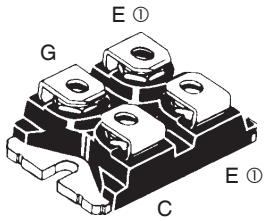
IXGN320N60A3

V_{CES} = 600V
I_{C110} = 170A
$V_{CE(sat)} \leq$ 1.30V

Ultra-Low-Vsat PT IGBT for
up to 5kHz Switching



SOT-227B, miniBLOC
E153432



G = Gate, C = Collector, E = Emitter

① Either Emitter Terminal Can Be Used as Main or Kelvin Emitter

Symbol	Test Conditions		Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C		600	V
V_{CGR}	T_J = 25°C to 150°C, R_{GE} = 1MΩ		600	V
V_{GES}	Continuous		±20	V
V_{GEM}	Transient		±30	V
I_{C25}	T_C = 25°C (Chip Capability)		320	A
I_{C110}	T_C = 110°C		170	A
I_{LRMS}	Terminal Current Limit		200	A
I_{CM}	T_C = 25°C, 1ms		1200	A
SSOA	V_{GE} = 15V, T_{VJ} = 125°C, R_G = 1Ω		I_{CM} = 320	A
(RBSOA)	Clamped Inductive Load		@0.8 • V_{CES}	
P_C	T_C = 25°C		735	W
T_J			-55 ... +150	°C
T_{JM}			150	°C
T_{stg}			-55 ... +150	°C
V_{ISOL}	50/60Hz	t = 1min	2500	V~
	$I_{ISOL} \leq$ 1mA	t = 1s	3000	V~
M_d	Mounting Torque		1.5/13	Nm/lb.in
	Terminal Connection Torque (M4)		1.3/11.5	Nm/lb.in
Weight			30	g

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
BV_{CES}	I_C = 1mA, V_{GE} = 0V	600			V
$V_{GE(th)}$	I_C = 4mA, V_{CE} = V_{GE}	3.0		5.5	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			150	μA
	T_J = 125°C			1.5	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±400	nA
$V_{CE(sat)}$	I_C = 100A, V_{GE} = 15V, Note 1		1.05	1.30	V
	I_C = 320A		1.46		V

Features

- Optimized for Low Conduction Losses
- High Avalanche Capability
- Isolation Voltage 3000 V~
- International Standard Package

Advantages

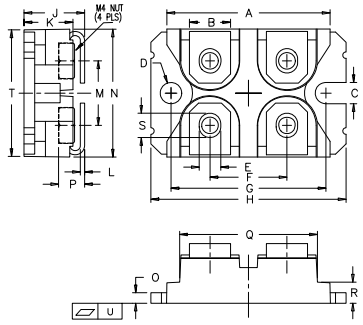
- High Power Density
- Low Gate Drive Requirement

Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- Inrush Current Protection Circuits

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
g_{fs}	I_C = 60A, V_{CE} = 10V, Note 1	70	125		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		18		nF
C_{oes}			985		pF
C_{res}			150		pF
$Q_{g(on)}$	I_C = 80V, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		560		nC
Q_{ge}			94		nC
Q_{gc}			195		nC
$t_{d(on)}$	**Resistive Load, T_J = 25°C**		63		ns
t_r	I_C = 80A, V_{GE} = 15V		68		ns
$t_{d(off)}$	V_{CE} = 400V, R_G = 1Ω		290		ns
t_f			740		ns
$t_{d(on)}$	**Resistive Load, T_J = 125°C**		62		ns
t_r	I_C = 80A, V_{GE} = 15V		77		ns
$t_{d(off)}$	V_{CE} = 400V, R_G = 1Ω		330		ns
t_f			1540		ns
R_{thJC}				0.17	°C/W
R_{thCK}			0.05		°C/W

SOT-227B miniBLOC (IXGN)



M4 screws (4x) supplied

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.240	1.255	31.50	31.88
B	.307	.323	7.80	8.20
C	.161	.169	4.09	4.29
D	.161	.169	4.09	4.29
E	.161	.169	4.09	4.29
F	.587	.595	14.91	15.11
G	1.186	1.193	30.12	30.30
H	1.496	1.505	38.00	38.23
J	.460	.481	11.68	12.22
K	.351	.378	8.92	9.60
L	.030	.033	0.76	0.84
M	.496	.506	12.60	12.85
N	.990	1.001	25.15	25.42
O	.078	.084	1.98	2.13
P	.195	.235	4.95	5.97
Q	1.045	1.059	26.54	26.90
R	.155	.174	3.94	4.42
S	.186	.191	4.72	4.85
T	.968	.987	24.59	25.07
U	-.002	.004	-0.05	0.1

Note 1. Pulse test, t ≤ 300µs, duty cycle, d ≤ 2%.

Fast Recovery Diodes (T-Modules), 40 A/70 A/85 A

D-55

FEATURES

- Fast recovery time characteristics
- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Standard JEDEC package
- Simplified mechanical designs, rapid assembly
- Large creepage distances
- UL E78996 approved
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level

RoHS COMPLIANT

DESCRIPTION

The series of T-modules uses fast recovery power diodes in a single diode configuration. The semiconductors are electrically isolated from the metal base, allowing common heatsink and compact assemblies to be built.
These single diode modules can be used in conjunction with the thyristor modules as a freewheel diode. Application includes self-commutated inverters, DC choppers, motor control, inductive heating and electronic welders. These modules are intended for those applications where very fast recovery characteristics are required and for general power switching applications.

PRODUCT SUMMARY	
$I_{F(AV)}$	40 A/70 A/85 A
Type	Modules - Diode, Fast

MAJOR RATINGS AND CHARACTERISTICS					
SYMBOL	CHARACTERISTICS	T40HFL	T70HFL	T85HFL	UNITS
$I_{F(AV)}$		40	70	85	A
$I_{F(RMS)}$		63	110	133	A
I_{FSM}	50 Hz	475	830	1300	A
	60 Hz	500	870	1370	
I^2t	50 Hz	1130	3460	8550	A^2s
	60 Hz	1030	3160	7810	
V_{RRM}	Range	100 to 1000			V
t_{rr}	Range	200 to 1000			ns
T_J	Range	- 40 to 125			°C

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	t_{rr} CODE	V_{RRM}, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM} MAXIMUM AT T_J = 25 °C µA
T40HFL.. T70HFL.. T85HFL..	10	S02, S05, S10	100	150	100
	20	S02, S05, S10	200	300	
	40	S02, S05, S10	400	500	
	60	S02, S05, S10	600	700	
	80	S05, S10	800	900	
	100	S05, S10	1000	1100	

FORWARD CONDUCTION

PARAMETER	SYMBOL	TEST CONDITIONS			T40HFL	T70HFL	T85HFL	UNITS
Maximum average forward current at case temperature	$I_{F(AV)}$	180° conduction, half sine wave			40	70	85	A
					70			°C
Maximum RMS forward current	$I_{F(RMS)}$				63	110	133	A
Maximum peak, one-cycle forward, non-repetitive surge current	I_{FSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	475	830	1300	A
		t = 8.3 ms			500	870	1370	
		t = 10 ms	100 % V_{RRM} reapplied		400	700	1100	
		t = 8.3 ms			420	730	1150	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		1130	3460	8550	A^2s
		t = 8.3 ms			1030	3160	7810	
		t = 10 ms	100 % V_{RRM} reapplied		800	2450	6050	
		t = 8.3 ms			730	2230	5520	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			11 300	34 600	85 500	$A^2\sqrt{s}$
Low level value of threshold voltage	$V_{F(TO)1}$	T_J = 25 °C, (16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$)			0.82	0.87	0.84	V
High level value of threshold voltage	$V_{F(TO)2}$	T_J = 25 °C, (I > π x $I_{F(AV)}$)			0.84	0.90	0.86	
Low level value of forward slope resistance	r_{f1}	T_J = 25 °C, (16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$)			7.0	2.77	2.15	mΩ
High level value of forward slope resistance	r_{f2}	T_J = 25 °C, (I > π x $I_{F(AV)}$)			6.8	2.67	2.07	
Maximum forward voltage drop	V_{FM}	I_{FM} = π x $I_{F(AV)}$, T_J = 25 °C, t_p = 400 µs square wave Average power = $V_{F(TO)}$ x $I_{F(AV)}$ + r_f x $(I_{F(RMS)})^2$			1.60	1.73	1.55	V

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

Document Number: 93184
Revision: 19-May-10

REVERSE RECOVERY CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS (1)	T40HFL			T70HFL			T85HFL			UNITS
			S02	S05	S10	S02	S05	S10	S02	S05	S10	
Maximum reverse recovery time	t_{rr}	T_J = 25 °C, -dI_F/dt = 100 A/µs I_F = 1 A to V_R = 30 V	70	110	270	70	110	270	80	120	290	ns
		T_J = 25 °C, -dI_F/dt = 25 A/µs I_{FM} = π x rated $I_{F(AV)}$, V_R = - 30 V	200	500	1000	200	500	1000	200	500	1000	
Maximum reverse recovery charge	Q_{rr}	T_J = 25 °C, -dI_F/dt = 100 A/µs I_F = 1 A to V_R = 30 V	0.25	0.4	1.35	0.25	0.4	1.35	0.3	0.6	1.6	µC
		T_J = 25 °C, -dI_F/dt = 25 A/µs I_{FM} = π x rated $I_{F(AV)}$, V_R = - 30 V	0.55	2.0	8.0	0.6	2.1	8.5	0.8	3.5	1.5	

Note

(1) Tested on LEM 300 A diodemeter tester

BLOCKING

PARAMETER	SYMBOL	TEST CONDITIONS	T40HFL	T70HFL	T85HFL	UNITS
Maximum peak reverse leakage current	I_{RRM}	T_J = 125 °C	20			mA
RMS isolation voltage	V_{ISOL}	50 Hz, circuit to base, all terminals shorted, T_J = 25 °C, t = 1 s	3500			V

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER		SYMBOL	TEST CONDITIONS	T40HFL	T70HFL	T85HFL	UNITS
Junction operating temperature range		T_J		- 40 to 125			°C
Storage temperature range		T_{Stg}		- 40 to 150			
Maximum internal thermal resistance, junction to case per module		R_{thJC}	DC operation	0.85	0.53	0.46	K/W
Thermal resistance, case to heatsink per module		R_{thCS}	Mounting surface, flat, smooth and greased	0.2			
Mounting torque ± 10 %	base to heatsink		M3.5 mounting screws (1) Non-lubricated threads	1.3 ± 10 %			Nm
	busbar to terminal		M5 screws terminals Non-lubricated threads	3 ± 10 %			
Approximate weight			See dimensions - link at the end of datasheet	54			g
				19			oz.
Case style				D-55 (T-module)			

Note

(1) A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound

ΔR CONDUCTION

DEVICES	SINUSOIDAL CONDUCTION AT T_J MAXIMUM					RECTANGULAR CONDUCTION AT T_J MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
T40HFL	0.06	0.08	0.10	0.14	0.24	0.05	0.08	0.10	0.15	0.24	K/W
T70HFL	0.05	0.06	0.08	0.11	0.19	0.04	0.06	0.08	0.12	0.19	
T85HFL	0.04	0.05	0.06	0.09	0.15	0.03	0.05	0.07	0.09	0.015	

Note

- The table above shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

ERM1604-1 Series

Character Module Datasheet

EastRising Technology Co., Limited

Attention:

A. Some specifications of IC are not listed in this datasheet. Please refer to the IC datasheet for more details.

B. The related documents for interfacing, demo code, ic datasheet are all available, please download from our web.

C. Please pay more attention to “INSPECTION CRITERIA” in this datasheet. We assume you already agree with these criterions when you place an order with us. No more recommendations.

REV	DESCRIPTION	RELEASE DATE
1.0	Preliminary Release	July-12-2012

2. SPECIFICATION

2.1 Display Specification

ITEM	STANDARD VALUE	UNIT
Resolution	16 Characters x 4 Lines	--
Display Connector	Pin Header, 16 pin	--
Operating Temperature	-20 ~ +70	℃
Storage Temperature	-30 ~ +80	℃
Touch Panel Optional	N/A	--
Font Chip Optional	N/A	--
*Sunlight Readable	No1,No3,No4,No5,No6,No7,No8	--

*Number of sunlight readable is from 1.1 ERM1604-1 Series Table of the datasheet.

2.2 Mechanical Specification

ITEM	STANDARD VALUE	UNIT
Outline Dimension	87.0(W) × 60.0(H) × 11.0(T) (MAX)	mm
Visual Area	61.80(W) × 25.20(H)	mm
Active Area	56.20(W) × 20.80(H)	mm
Character Size	2.95(W) × 4.75(H)	mm
Dot Size	0.55×0.55	mm
Dot Pitch	0.60 ×0.60	mm
Net Weight	60 ± 15% grams (typical)	g

2.3 Electrical Specification

ITEM	STANDARD VALUE	UNIT
IC Package	COB	--
Controller	HD44780 or Equivalent KS0066 or SPLC780	--
Interface	6800 8-bit Parallel, 6800 4-bit Parallel	--

2.4 Optical Specification

ITEM	STANDARD VALUE	UNIT
LCD Type	Refer to 1.1 ERM1604-1 Series Table	--
Backlight Color	Refer to 1.1 ERM1604-1 Series Table	--
Viewing Direction	6:00	Clock
LCD Duty	1/16	Duty
LCD Bias	1/5	Bias

4. ELECTRICAL SPEC

4.1 Pin Configuration

Pin No	Pin Name	Descriptions
1	VSS	Ground ,0V
2	VDD	Logic Power Supply
3	V0	Operating voltage for LCD
4	RS	Data / Instruction Register Select (H: Data Signal, L: Instruction Signal)
5	R/W	Read / Write (H: Read Mode, L: Write Mode)
6	E	Enable Signal
7	DB0	Data Bit 0
8	DB1	Data Bit 1
9	B2	Data Bit 2
10	DB3	Data Bit 3
11	DB4	Data Bit 4
12	DB5	Data Bit 5
13	DB6	Data Bit 6
14	DB7	Data Bit 7
15	LED_A	Backlight Anode
16	LED_K	Backlight Cathode

4.2 Absolute Maximum Ratings

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-VSS	-0.3	-	+7.0	V
Power Supply for LCD	VLCD	VDD-15	-	VDD+0.3	V
Input Voltage	VIN	-0.3	-	VDD+0.3	V
Supply Current for Backlight	ILED	-	-	75	mA

4.3 Electrical Characteristics

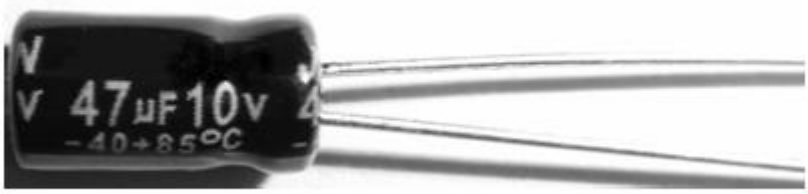
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply for LCM	VDD-VSS	VDD=5V	4.8	5.0	5.2	V
		VDD=3.3V	3.0	3.3	3.6	V
Input Voltage	VIL	L Level	-0.2	-	1	V
	VIH	H Level	VDD-1.0	-	VDD	V
LCD Driving Voltage	VDD-V0	-	4.5	4.8	5.1	V
Supply Current for LCM	IDD	-	-	-	1800.0	uA
Supply Current for Backlight	ILED	-	-	45	-	mA

ENGLISH

Datasheet

100µF 400 V dc, Through Hole Aluminium Electrolytic Capacitor

RS Stock number [711-2096]



Specifications:

Item	Performance Characteristics	
Operating Temperature Range	-40 to +105□	-25 to +105□
Rated Voltage Range	6.3 to 100 VDC	160 to 450 VDC
Capacitance Tolerance	±20%(120Hz, +20□)	
Leakage Current (+20□)	10V ~100V DC: I≦0.01CV+3(uA) 160V~450V DC: I≦0.03CV+3(uA) I: Leakage current(uA) C: Rated Capacitance(uF) V: Working Voltage[V] After 1minute whichever is greater measured with rated working voltage applied.	

Dissipation Factor [120Hz,20 °C]	W.V	6.3	10	16	25	35	50	63	100	160	200	250	350	400	450
	Tanθ	0.23	0.20	0.16	0.14	0.12	0.10	0.10	0.10	0.15	0.15	0.16	0.20	0.20	0.20

For capacitance exceeding 1000uF,add 0.02 per increment of 1000uF

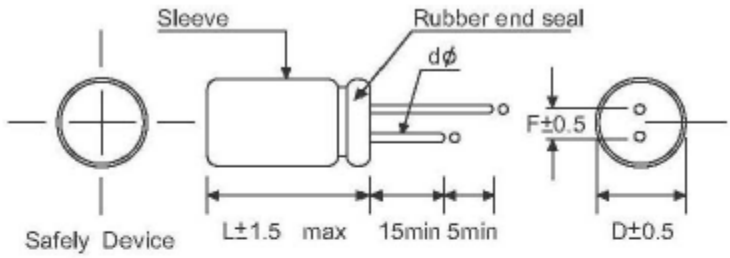
Temperature Caracteristics [Tanθ]	W.V.		6.3	10	16	25	35	50	63	100	160	200	250	350	400	450
	Impedance	-25 °C/+20 °C	4	3	2	2	2	2	2	2	3	3	3	5	6	15
		-40 °C/+20 °C	8	6	4	3	3	3	3	3	-	-	-	-	-	-

Impedance ratio of 120Hz

Load Test	Test conditions Duration time : 5Ø~6Ø1000Hrs 8Ø~25Ø 2000Hrs Ambient temperature:+105□ Applied voltage: Rated DC working voltage After test requirements:at+20□ After test requirements:□±20% of the initial measured value Dissipation Factor: □200% of the initial specified value Leakage current: □The initial specified value
Shelf Test	Test conditions Duration time :500Hrs Ambient temperature:+105□ Applied voltage: None After test requirements at +20□: Some limits as Load life. Pre-treatment for measurements shall be conducted after application of DC working voltage for 30 minutes.

ENGLISH

Diagram of Dimensions:



(Unit: mm)

D	5	6	8	10	13	16	18	22	25
F	2.0	2.5	3.5	5.0	5.0	7.5	7.5	10	12
φd	0.5			0.6		0.8			1.0

Ripple Current & Temperature

Temperature (□)	45	60	70	85	105
Multiplier	2.10	1.90	1.65	1.40	1.00

Ripple Current & Frequency Multipliers

Cap.(μF) \ Freq.(Hz)		50(60)	120	400	1K	10K	50-100K
Multiplier	CAP□10	0.8	1.0	1.30	1.45	1.65	1.70
	10<CAP□100	0.8	1.0	1.23	1.36	1.48	1.53
	100<CAP□1000	0.8	1.0	1.16	1.25	1.35	1.38
	1000<CAP	0.8	1.0	1.11	1.18	1.25	1.28

Supply Monitoring Series SM 500

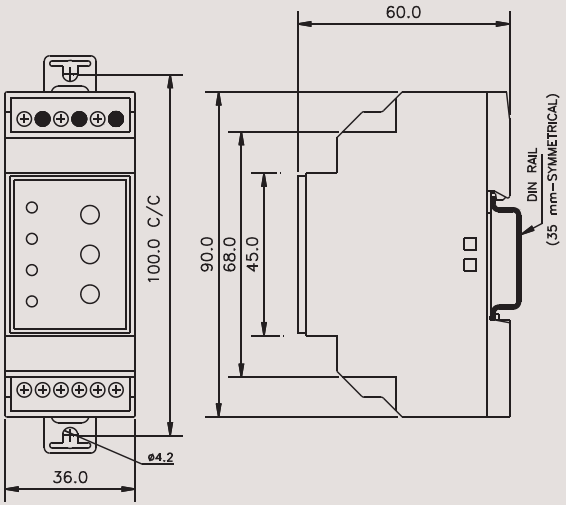
Cat. No.		MG73BH
Parameters		
Supply Voltage (Un):		3 Phase 4 Wire, 240 VAC 1 Phase, 240 VAC
Frequency		48 - 63 Hz
Power Consumption		5VA
Trip Settings : Under Voltage Over Voltage Phase - Phase Unbalance (Asy.) Phase Reverse Detect Hysteresis		 55% - 95% of Un 105% - 125% of Un 10% Yes 7 V ± 2 V of trip voltage (factory set) Note: Voltage setting is with respect to neutral
Time Delays: ON Delay OFF Delay		0 to 15 s (Adjustable) 5 s (Fixed)
Setting Accuracy		± 10 % of full scale.
Contact Rating Electrical Life Mechanical Life		2 C/O (DPDT) 5A (Resistive) @ 250 VAC / 28 VDC $1X10^5$ $3X10^6$
Utilization Category	AC - 15	Rated Voltage (Ue): - 120/240 V, Rated Current (Ie) :- 3/1.5 A
	DC - 13	Rated Voltage (Ue): - 24/125/250 V, Rated Current (Ie) :- 2/0.22/0.1 A
Operating Temperature Storage Temperature		- 10°C to +55°C - 25°C to +70° C
LED Indication		Separate indications for Power ON, UV, OV; ON: Phase Reverse, BLINK: Phase Unbalance (Asy.)
Housing Dimension (W x H x D) Weight		UL 94VO 36 X 90 X 60 (in mm) 120 g (unpacked)
Mounting		Base / DIN rail
Degree of Protection		IP20 for Terminal, IP 40 for Enclosure
Certification		CE , IEC 60255
EMI/ EMC Radio Interference Suppression ESD Electrical Fast Transients Surges Voltage Dips, Interruptions Isolation		 CISPR 14-1 Class B IEC 61000-4-2 Level III IEC-61000-4-4 Level IV IEC-61000-4-5 Level IV IEC-61000-4-11 All 7 Levels Test voltage between input & output - IEC 60255-5, 2kV

Note: 1) In the event of Phase sequence or phase loss, OFF delay is 100 ms

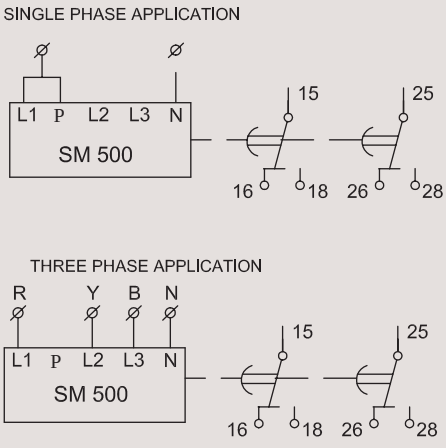
ORDERING INFORMATION

Cat. No.	Description
MG73BH	3 Phase 4 Wire, UV/OV & single phasing Protection with adjustable 0 to 15 s On delay time, 2 C/O

MOUNTING DIMENSION (mm)



CONNECTION DIAGRAM



Frequency Monitoring Series PD 225

- Wide Auxiliary Supply voltage Range: 110 - 240 VAC, 220 - 440 VAC
- Models for Over Frequency and Under/Over Frequency Monitoring
- Monitors Frequency of Three signals - Sine, Square & Triangular
- Model for Frequency Limit Control: 5 Hz to 135 Hz
- Wide Signal Input Voltage: 15 to 500 VAC
- Adjustable Relay status in Healthy or Unhealthy condition using DIP switch "ET" (Energize to Trip) or "DT" (De-energize to trip.)
- Ease of Frequency setting with simple Addition & Subtraction
- LED Indications for Healthy, Unhealthy & No signal conditions

Cat. No.			MI81BJ	MI91BL
Parameters				
Supply Voltage (⏚)			110 - 240 VAC	220 - 440 VAC
Supply Variation			-15% to +15% (of ⏚)	
Frequency			50/60 Hz	
Power Consumption (Max.)			3 VA	
Signal Type			Sinusoidal, Square, Triangular	
Signal Input Voltage Range			(15 to 500) V	
Overall Frequency Range			(5 to 135) Hz	(40 to 70) Hz
Trip Settings	Over Frequency		0.33 to 1 of Full Scale	(+1 to +10) Hz above Selected Value
	Under Frequency		N A	(-1 to -10) Hz below Selected Value
	Reset Hysteresis		1.5 % of Full Scale selected	
Setting Accuracy			± 5%	
Repeat Accuracy			± 0.02%	
Time Delay	ON Delay		500 ms	500 ms to 5 s
	OFF Delay		100 ms	
	Reset Time		150 ms	
Output	Relay Output		1 C/O	
	Contact Rating		6A (Resistive) @ 250 VAC / 28 VDC	
	Electrical Life		1 x 10^5	
	Mechanical Life		3 x 10^6	
Utilization Category		AC - 15	Rated Voltage (Ue): 120/240 V, Rated Current (Ie): 3.0/1.5 A	
		DC - 13	Rated Voltage (Ue): 24/125/250 V, Rated Current (Ie): 2.0/0.22/0.1 A	
LED Indications	Relay		Red LED Flashing if No Signal	N A
	UF / OF		N A	Separate for UF & OF
Operating Temperature			- 15° C to +60° C	
Storage Temperature			- 25° C to +80° C	
Enclosure			Flame Retardant UL94-V0	
Dimension (W x H x D) (in mm)			22.5 X 75 X 100.5	
Weight (unpacked)			120 g	
Mounting			Base / DIN rail	
Certification			CE cULus LISTED RoHS Compliant	
Degree of Protection			IP 20 for Terminals, IP 40 for Enclosure	

EMI / EMC		
Harmonic Current Emissions	IEC 61000-3-2	Ed. 3.0 (2005-11) Class A
ESD	IEC 61000-4-2	Ed. 1.2 (2001-04) Level II
Radiated Susceptibilty	IEC 61000-4-3	Ed. 3.0 (2006-02) Level III
Electrical Fast Transients	IEC 61000-4-4	Ed. 2.0 (2004-07) Level IV
Surges	IEC 61000-4-5	Ed. 2.0 (2005-11) Level IV
Conducted Susceptibilty	IEC 61000-4-6	Ed. 2.2 (2006-05) Level III
Voltage Dips & Interruptions (AC)	IEC 61000-4-11	Ed. 2.0 (2004-03) All 7 Levels
Conducted Emission	CISPR 14-1	Ed. 5.0 (2005-11) Class A
Radiated Emission	CISPR 14-1	Ed. 5.0 (2005-11) Class B

Environmental		
Cold Heat	IEC 60068-2-1	Ed. 6.0 (2007-03)
Dry Heat	IEC 60068-2-2	Ed. 5.0 (2007-07)
Vibration	IEC 60068-2-6	Ed. 7.0 (2007-12) 5g
Repetitive Shock	IEC 60068-2-27	Ed. 4.0 (2008-02) 40g, 6ms
Non-Repetitive Shock	IEC 60068-2-27	Ed. 4.0 (2008-02) 30g, 15ms

ORDERING INFORMATION

Cat. No.	Description
MI81BJ	110 - 240 VAC, Over Frequency Relay, 1 C/O
MI91BJ	220 - 440 VAC, Over Frequency Relay, 1 C/O
MI81BL	110 - 240 VAC, Over Frequency & Under Frequency Relay, 1 C/O
MI91BL	220 - 440 VAC, Over Frequency & Under Frequency Relay, 1 C/O

UL Approval for Cat Nos. MI81BL & MI91BL only.

Technical Data Sheet

Sigma Series DE Meter

The moving iron panel meters, DE 48/72/96/144 are housed in a moulded polycarbonate cases which are suitable for the measurement of AC currents for frequency range of 15...400Hz and voltages in the frequency range of 15...100Hz.

Special Features

- Scale interchangeability
- Near linear scale
- Glass filled polycarbonate housing (UL 94 V-0)
- Knife edge pointer
- Easily replace able glass and bezel

Application

The moving iron panel meters, DE 48/72/96/144 housed in moulded polycarbonate cases are suitable for the measurement of AC currents for frequency range of 15...400Hz and voltages in the frequency range of 15...100Hz.

Movement

Moving iron movement has pivots of very high hardness.Movement suspended between spring loaded saphire jewel and silicon jewel.Movement is critically damped by use of silicon oil.

Technical Specifications

Applicable Standards

Nominal case and cutout dimensions for indicating Electrical instruments	DIN IEC 61554
Scale and pointer for electrical measuring instruments	DIN 43802
Connections and Terminal markings	DIN 43807
Terminal bolts/leads	DIN 46200/46282
Safety requirements and protective measures for Electrical indicating. instruments and their accessories	DIN 40050, VDE 0110, VDE 0410 IEC 529, IEC 1010
Performance specifications for direct acting indicating analogue electrical measuring instruments and their accessories	IEC51/DINEN60051 DIN 43701
Environmental conditions	VDE / VDI 3540
Front frames for indicating measuring instruments Principle dimensions	DIN 43718
ULCombustibility	UL 94 V-0

Comply with following European directives

2004 / 108 / EC (EMC directive), 2006 / 95/EC (low voltage directive) & amendment 93/68/EEC, For CE Marking.

Scale and Pointer

Pointer	Knife - edge pointer			
Pointer deflection	0...90			
Scale characteristics	Near Linear above 10% of nominal full Scale value			
Scale division	Coarse - fine			
Scale length	DE 48	DE72	DE 96	DE144
	41 mm	63mm	97mm	146mm

Over Range

Ammeters	2 times nominal current
Voltmeters	1.2 times nominal voltage
Scale Interchangeability	Interchangeable
nd drip proof as	per UL 94 V-0

Mechanical Data

Case details	Moulded square case suitable for mounting in Control / switchgear panels Machinery consoles.
Case material	Polycarbonate , flame retardant and drip proof as per UL 94 V-0.
Front facia	Glass
Colour of bezel	Black
Position of use	Vertical
Panel fixing	Mounting Clamp
Mounting	Stackable in a single cutout
Panel thickness	≤ 25 mm

Terminals

Voltmeters and Ammeters < 30 A	Hexagon studs, M4 screws and wire clamps E3
Ammeters < 30 A	Threaded studs M6 with Nuts
Ammeters < 60A	Threaded Studs M8 with Nuts

Electrical Data

Measured Quantity Power Consumption	AC Voltage or current
Voltmeters	< 4.5 VA
Ammeters < 15A	< 0.5 VA
Ammeters > 15A	< 0.8 VA
Continuous Overload Capacity	I(acc. to IEC 51) 1.2 times rated voltage / current.

Short Duration

Voltameters	2 times for 0.5 sec : 9 overloads 2 times 5 sec : 1 overloads
Ammeters	10 times for 0.5 sec : 9 overloads 10 times for 5 sec : 1 overload
Enclosure code (IEC 529)	IP 52 case IP 00 for terminals without back cover IP 20 for terminals with back cover
Insulation class	Group A according to VDE 0110
Rated insulation	DE 48 : 660V DE 72/96 : 1KV
Proof voltage	DE 48 : 2KV DE 72/96 : 3KV
Installation category	> 50 Mohm at 500 V DC

Reference Conditions

Accuracy class	0.5 according to IS : IEC 51/DIN EN 60051)
Ambient temperature	23 C ± 2°C
Position of use	Nominal position ±1°
Input Waveform	Rated value of measured quantity sine wave, distortion factor ≤ 5%
Freequency	65HZ
Other Conditions	IEC 51/DIN EN 60051

Nominal Range of use

Ambient Temperature	0 ...50 °C
Position of use	Vertical ± 5°
Frequency	45 ...65Hz
External Magnetic Field	At 0.4 kA/m

Environmental Conditions

Climatic Suitability	Climate category || as per IS : 1248, IEC 60051(climatic class 3 according to VDE/VDI 3540)
Operating Temperature	- 10... + 55 C
Storage temperature	- 25...+65 C
Relative humidity	≤ 75% annual average, noncondensing
Shock resistance	15 g. for pulse duration 11ms
Vibration resistance	10-55-10Hz for ampli. 0.15mm (1.5g at50Hz)
Pollution degree	Stackable in a single cutout

Environmental Conditions

A.C. Voltage	A.C. Current
6V	100mA
10v	150mA
15v	250mA
25v	400mA
40v	600mA
60v	1A
100v	1.5A
120v	2.5A
132v	4A
150v	5A
250v	6A
400v	10A
500v	15A
600v	20A
1000v	25A
for use with PT	40A
.../100 V s econdary	50A (except DE 48)
.../110 V secondary	60A (except DE 48)
	100A (except DE 48)
	For use with CT
	.../1A secondary
	.../5A secondary

Technical Data Sheet

Sigma Series DE Meter

The moving iron panel meters, DE 48/72/96/144 are housed in a moulded polycarbonate cases which are suitable for the measurement of AC currents for frequency range of 15...400Hz and voltages in the frequency range of 15...100Hz.

Special Features

- Scale interchangeability
- Near linear scale
- Glass filled polycarbonate housing (UL 94 V-0)
- Knife edge pointer
- Easily replace able glass and bezel

Application

The moving iron panel meters, DE 48/72/96/144 housed in moulded polycarbonate cases are suitable for the measurement of AC currents for frequency range of 15...400Hz and voltages in the frequency range of 15...100Hz.

Movement

Moving iron movement has pivots of very high hardness.Movement suspended between spring loaded saphire jewel and silicon jewel.Movement is critically damped by use of silicon oil.

Technical Specifications

Applicable Standards

Nominal case and cutout dimensions for indicating Electrical instruments	DIN IEC 61554
Scale and pointer for electrical measuring instruments	DIN 43802
Connections and Terminal markings	DIN 43807
Terminal bolts/leads	DIN 46200/46282
Safety requirements and protective measures for Electrical indicating. instruments and their accessories	DIN 40050, VDE 0110, VDE 0410 IEC 529, IEC 1010
Performance specifications for direct acting indicating analogue electrical measuring instruments and their accessories	IEC51/DINEN60051 DIN 43701
Environmental conditions	VDE / VDI 3540
Front frames for indicating measuring instruments Principle dimensions	DIN 43718
ULCombustibility	UL 94 V-0

Comply with following European directives

2004 / 108 / EC (EMC directive), 2006 / 95/EC (low voltage directive) & amendment 93/68/EEC, For CE Marking.

Scale and Pointer

Pointer	Knife - edge pointer			
Pointer deflection	0...90			
Scale characteristics	Near Linear above 10% of nominal full Scale value			
Scale division	Coarse - fine			
Scale length	DE 48	DE72	DE 96	DE144
	41 mm	63mm	97mm	146mm

Over Range

Ammeters	2 times nominal current
Voltmeters	1.2 times nominal voltage
Scale Interchangeability	Interchangeable
nd drip proof as	per UL 94 V-0

Mechanical Data

Case details	Moulded square case suitable for mounting in Control / switchgear panels Machinery consoles.
Case material	Polycarbonate , flame retardant and drip proof as per UL 94 V-0.
Front facia	Glass
Colour of bezel	Black
Position of use	Vertical
Panel fixing	Mounting Clamp
Mounting	Stackable in a single cutout
Panel thickness	≤ 25 mm

Terminals

Voltmeters and Ammeters < 30 A	Hexagon studs, M4 screws and wire clamps E3
Ammeters < 30 A	Threaded studs M6 with Nuts
Ammeters < 60A	Threaded Studs M8 with Nuts

Electrical Data

Measured Quantity Power Consumption	AC Voltage or current
Voltmeters	< 4.5 VA
Ammeters < 15A	< 0.5 VA
Ammeters > 15A	< 0.8 VA
Continuous Overload Capacity	I(acc. to IEC 51) 1.2 times rated voltage / current.

Short Duration

Voltameters	2 times for 0.5 sec : 9 overloads 2 times 5 sec : 1 overloads
Ammeters	10 times for 0.5 sec : 9 overloads 10 times for 5 sec : 1 overload
Enclosure code (IEC 529)	IP 52 case IP 00 for terminals without back cover IP 20 for terminals with back cover
Insulation class	Group A according to VDE 0110
Rated insulation	DE 48 : 660V DE 72/96 : 1KV
Proof voltage	DE 48 : 2KV DE 72/96 : 3KV
Installation category	> 50 Mohm at 500 V DC

Reference Conditions

Accuracy class	0.5 according to IS : IEC 51/DIN EN 60051)
Ambient temperature	23 C ± 2°C
Position of use	Nominal position ±1°
Input Waveform	Rated value of measured quantity sine wave, distortion factor ≤ 5%
Freequency	65HZ
Other Conditions	IEC 51/DIN EN 60051

Nominal Range of use

Ambient Temperature	0 ...50 °C
Position of use	Vertical ± 5°
Frequency	45 ...65Hz
External Magnetic Field	At 0.4 kA/m

Environmental Conditions

Climatic Suitability	Climate category || as per IS : 1248, IEC 60051(climatic class 3 according to VDE/VDI 3540)
Operating Temperature	- 10... + 55 C
Storage temperature	- 25...+65 C
Relative humidity	≤ 75% annual average, noncondensing
Shock resistance	15 g. for pulse duration 11ms
Vibration resistance	10-55-10Hz for ampli. 0.15mm (1.5g at50Hz)
Pollution degree	Stackable in a single cutout

Environmental Conditions

A.C. Voltage	A.C. Current
6V	100mA
10v	150mA
15v	250mA
25v	400mA
40v	600mA
60v	1A
100v	1.5A
120v	2.5A
132v	4A
150v	5A
250v	6A
400v	10A
500v	15A
600v	20A
1000v	25A
for use with PT	40A
.../100 V s econdary	50A (except DE 48)
.../110 V secondary	60A (except DE 48)
	100A (except DE 48)
	For use with CT
	.../1A secondary
	.../5A secondary

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STC SERIES

THREE-PHASE A.C.SYNCHRONOUS GENERATORS

This series generators are to be used in town, countryside, worksites, mountain and pasture as electric power source for lighting purpose, it can also he used as reserved power source for emergent case using. The generators are of dripproof with rotary field type and adopt harmonic excitation system, easy operation and maintenance.
The generators are three-phase, four-wire type, adopting star connection with neutral point. The rated line voltage is 400V, phase voltage 230V, frequency 50Hz. power factor 0.8(lag). We can provide 60Hz and the other voltage's generator according to the customer's request. They can be coupled with a prime mover directly or through v-belt making right or reverse continuous rotation at the rated speed. When the rotation speed of prime mover changs 3% or so and load varies in the range of 0~100% cos j 0.8~1.0, the generators offer constant voltage, when sudden change (increase or decrease) of load, the generator will soon return to their normal working state, at the same time, without any starting device the generator can directly start an unloaded squirrel cage induction motor.

OPERATING CONDITIONS

Cooling air temperature:-15°C~40°C
Above sea level: not exceed 1000m
Relative air damping: not exceed 90%

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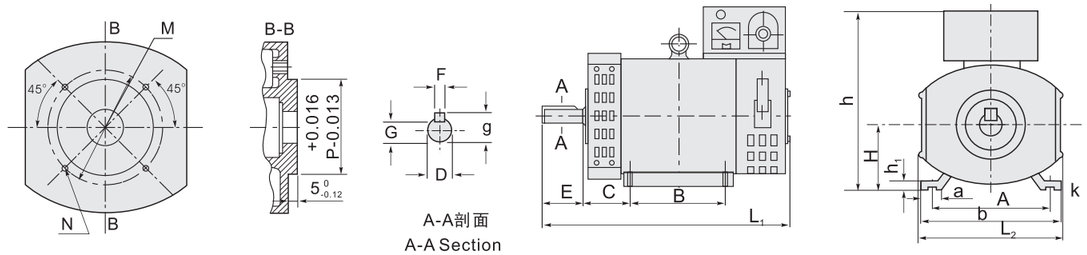
SPECIFICATION

Model	Output KVA	Output KW	Voltage(V)	Current(A)	Power factor ($\cos\phi$)	Speed(r/min)	Pole number	Volt.Regu.
STC-3	3.8	3.0	400	5.4	0.8	1500	4	±7%
STC-5	6.3	5.0	400	9	0.8	1500	4	±7%
STC-7.5	9.4	7.5	400	13.5	0.8	1500	4	±7%
STC-10	12.5	10	400	18.1	0.8	1500	4	±7%
STC-12	15	12	400	21.7	0.8	1500	4	±7%
STC-15	18.8	15	400	27.1	0.8	1500	4	±7%
STC-20	25	20	400	36.1	0.8	1500	4	±7%
STC-24	30	24	400	43.3	0.8	1500	4	±7%
STC-30	37.5	30	400	54.1	0.8	1500	4	±7%
STC-40	50	40	400	72.2	0.8	1500	4	±7%
STC-50	62.5	50	400	90.2	0.8	1500	4	±7%



INSTALLATION AND OVERALL DIMENSION

Model	Installing dimensions												External dimensions							Weight (kg)
	A	B	C	D	E	F	G	H	K	M	N	P	a	b	h1	h	L1	L2	g	
STC-3	216	178	89	32	80	10	26.8	132	12	-	-	-	34	250	18	400	480	270	34.8	70
STC-5	254	254	108	38	80	12	32.8	160	15	-	-	-	50	310	25	450	580	325	40.8	120
STC-7.5	254	254	108	38	80	12	32.8	160	15	-	-	-	50	310	25	450	580	325	40.8	130
STC-10	279	203	121	42	110	12	36.8	180	15	265	4-M12	230	60	339	25	490	610	365	44.8	140
STC-12	279	203	121	42	110	12	36.8	180	15	265	4-M12	230	60	339	25	490	610	365	44.8	155
STC-15	318	228	133	48	110	14	42.2	200	19	300	4-M16	250	60	378	30	500	660	400	51.2	192
STC-20	318	228	133	48	110	14	42.2	200	19	300	4-M16	250	60	378	30	500	660	400	51.2	202
STC-30	356	286	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	770	452	64	257
STC-40	356	286	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	770	452	64	290
STC-50	356	311	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	810	452	64	344

Note: If select Model" B" end cover you should write" B" on your order as STC-10B, If the" B" is not written on the order provide Model" A" for you word" A" is unnecessary the later such as STC-10.
We are able to make derivative products and products for special purposes according to customers' requirements.

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OPERATING CONDITIONS

Cooling air temperature:-15°C~40°C
Above sea level: not exceed 1000m
Relative air damping: not exceed 90%

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SPECIFICATION

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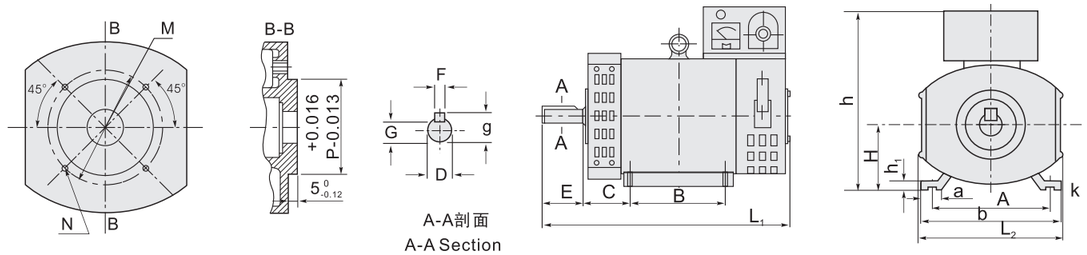
STC-3	3.8	3.0	400	5.4	0.8	1500	4	±7%
STC-5	6.3	5.0	400	9	0.8	1500	4	±7%
STC-7.5	9.4	7.5	400	13.5	0.8	1500	4	±7%
STC-10	12.5	10	400	18.1	0.8	1500	4	±7%
STC-12	15	12	400	21.7	0.8	1500	4	±7%
STC-15	18.8	15	400	27.1	0.8	1500	4	±7%
STC-20	25	20	400	36.1	0.8	1500	4	±7%
STC-24	30	24	400	43.3	0.8	1500	4	±7%
STC-30	37.5	30	400	54.1	0.8	1500	4	±7%
STC-40	50	40	400	72.2	0.8	1500	4	±7%
STC-50	62.5	50	400	90.2	0.8	1500	4	±7%



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STC-30	356	286	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	770	452	64	257
STC-40	356	286	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	770	452	64	290
STC-50	356	311	149	60	140	18	53	225	20	350	4-M16	300	65	421	32	650	810	452	64	344

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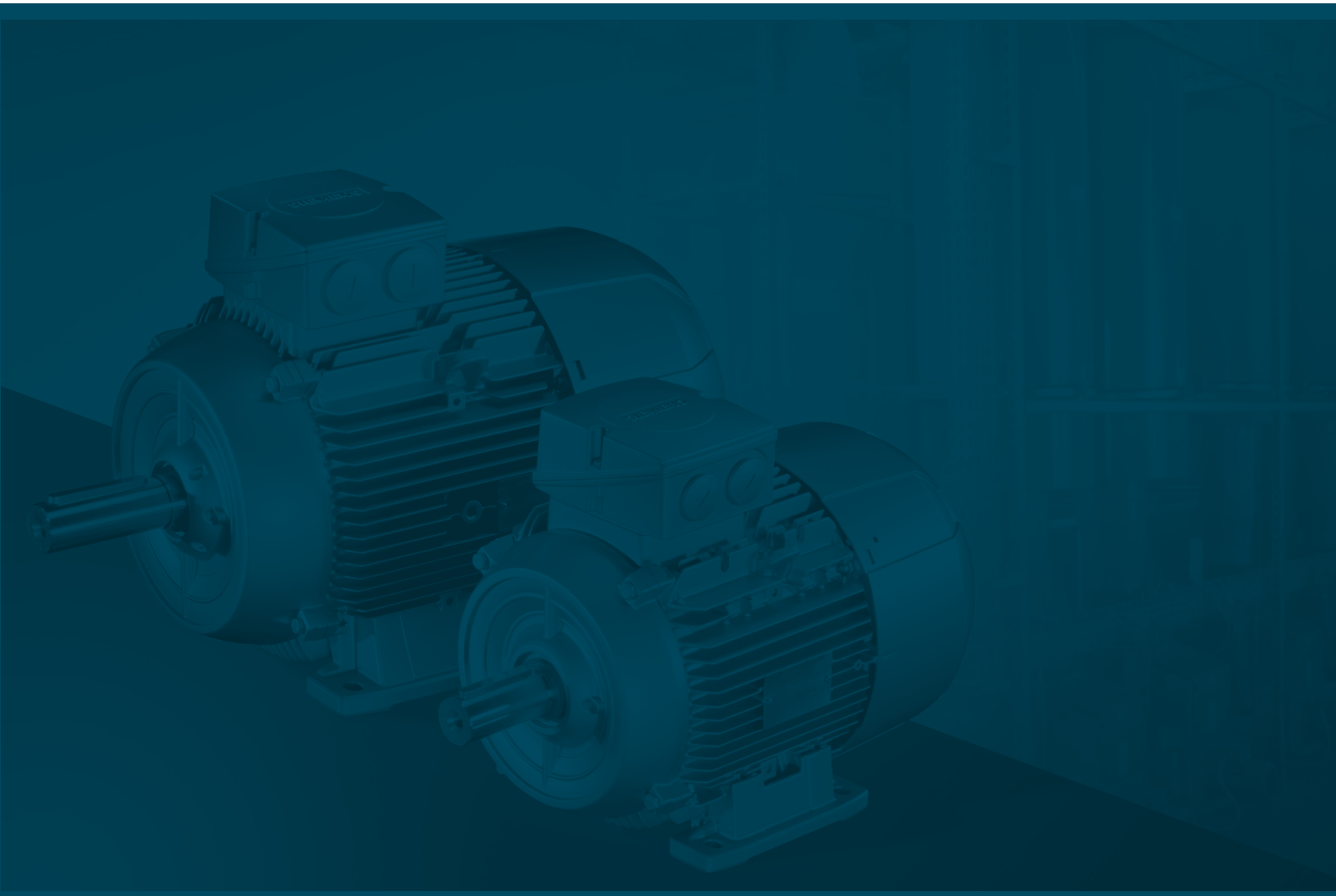
CATÁLOGO
MOTORES ELÉCTRICOS



SARGENT

MOTORES ELÉCTRICOS 1LA7 Y 1LG4 DESDE LOS 0,18 A 200 KW

MOTORES 2 POLOS

Referencia	Potencia (Kw)	Frame	Velocidad (RPM)	Rendimiento	Factor de potencia	Corriente a 400 V
1LA70602AA10	0,18	63M	2820	63	0,82	0,51
1LA70632AA10	0,25	63M	2830	65	0,82	0,68
1LA70702AA10	0,37	71M	2740	66	0,82	1
1LA70732AA10	0,55	71M	2800	71	0,82	1,36
1LA70802AA10	0,75	80M	2855	73	0,86	1,73
1LA70832AA10	1,1	80M	2845	77	0,87	2,4
1LA70902AA10	1,5	90S	2860	79	0,85	3,25
1LA70962AA10	2,2	90L	2880	82	0,85	4,55
1LA71062AA10	3	100L	2890	84	0,85	6,1
1LA71132AA60	4	112M	2905	86	0,86	7,8
1LA71302AA60	5,5	132S	2925	86,5	0,89	10,3
1LA71312AA60	7,5	132S	2930	88	0,89	13,8
1LA71632AA60	11	160M	2940	89,5	0,88	20
1LA71642AA60	15	160M	2940	90	0,9	26,5
1LA71662AA60	18,5	160L	2940	91	0,91	32,5
1LG41832AA60	22	180M	2945	91,4	0,86	40,5
1LG42062AA60	30	200L	2950	91,7	0,88	54
1LG42072AA60	37	200L	2950	92,4	0,89	65
1LG42232AA60	45	225M	2960	93,4	0,88	79
1LG42532AB60	55	250M	2970	93,6	0,88	96
1LG42802AB60	75	280S	2975	94,3	0,88	130
1LG42832AB60	90	280M	2975	94,8	0,89	154
1LG43102AB60	110	315S	2982	94,4	0,88	192
1LG43132AB60	132	315M	2982	94,9	0,9	225
1LG43162AB60	160	315L	2982	95,4	0,91	265
1LG43172AB60	200	315L	2982	95,8	0,92	330