

SafeFit Reference: IEC-61709

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SAFETWICE

Change Control

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Abstract

This document lists all supported parameters in SafeFit for the standard **IEC-61709**.

Names in the **Parameter** column are the exact string of CSV columns recognized by SafeFit. The **Value** column indicates possible values, which can be:

- Designator specification, e.g. $R<Num>[<Char>]$. This means: a letter, an integer (any number digits), and an optional upper case character, e.g. R1A, R15, etc.
- Integer ranges, e.g. $x \geq 0$.
- Real number ranges, e.g. $x \geq 0.0 [W]$, $x \text{ in } R [^{\circ}C]$ (any real number). Characters between square brackets [] specify the units in SI format (generally).
- Enumeration values, e.g. RCR (1), RM (6). As with parameter names, these exact names are required for successful recognition. *Additionally*, their index in the list of values can also be used (zero-based). For a resistor, RCR is 1, and RM is 6.

Sensitivity tables indicate which parameters are required to compute the FIT for a given component type. Some require all, a few depend only on global parameters, and the rest depend on a subset.

Abbreviations:

- Top: operation temperature
- Uop: operation voltage
- Iop: operation current
- Urat: rated voltage
- Irat: rated voltage
- Sop: operation switching rate
- Sref: reference switching rate
- Tref: reference temperature



1 Capacitors

1.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Paper, Metallized Paper, Metallized PP Film, Metallized PET Film, Metallized Cellulose Acetate Film, PC Film Metal Foil, Metallized PC Film, PS Film, PET Film Metal Foil, PP Film Metal Foil, Glass, Mica, Ceramic, Deposited, Electrolytic Al Non-Solid, Electrolytic Al Solid, Electrolytic Ta Non-Solid, Electrolytic Ta Solid, Variable
FIT Exp	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

1.2 Operational

Parameter	Value
Designator	C<Num>[<Char>] (e.g. C1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
Profile	None, Dormancy, Complex

Parameter	Value
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

1.3 Sensitivity

Complete - all parameters are used in all cases.



2 Semiconductors

2.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Transistor, Diode, Power
Subtype	Bipolar Universal, Transistor Arrays, Bipolar Low, Bipolar Power, FET Junction, FET MOS, MOS Power, RF Bipolar, RF Bipolar Power, RF GaAs FET Low, RF GaAs FET Medium, RF GaAs FET Power, RF MOSFET Low, RF MOSFET Power
FIT Exp	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

2.2 Operational

Parameter	Value
Designator	(Q D THY SCR)<Num>[<Char>] (e.g. Q1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Subtype	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

2.3 Sensitivity

Type	Sensitivity
Transistor	Top, Uop
Diode	Top
Power	Top



3 Inductors

3.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	EMC <= 3A, EMC > 3A, Low Frequency, High Frequency, Main Transformer
FIT Exp	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

3.2 Operational

Parameter	Value
Designator	(L T)<Num>[<Char>] (e.g. L1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

3.3 Sensitivity

Complete - all parameters are used in all cases.

4 Integrated Circuits

4.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Memory, Micro, Digital, Analog, ASIC
Subtype (Memory)	<i>Depends on Type</i> Bipolar RAM, FIFO, Bipolar PROM, MOS RAM, MOS RAM, FIFO, MOS ROM mask, MOS EPROM, OTPROM, MOS FLASH, MOS EEPROM, EAPROM
(Micro)	Bipolar, NMOS $\leq 50k$, NMOS $> 50k$, CMOS $\leq 5k$, CMOS 5k-50k, CMOS 50k-500k, CMOS $> 500k$, BICMOS
(Digital)	Bipolar TTL, Bipolar Bus IF, Bipolar TTL S, Bipolar ECL 10k, Bipolar ECL 100k, Bipolar ECL 10/100LV, CMOS Logic, Analog SW, Bus IF, CMOS Bus IF GTL, CMOS Bus Driver, BICMOS Logic, BICMOS Bus IF ABT/BCT, BICMOS Bus IF LVT, BICMOS Bus IF GTL, BICMOS Bus IF BTL/ETL, BICMOS Bus Driver
(Analog)	Bipolar Opamp, Comp, V-Monitor, CMOS Opamp, Comp, V-Monitor, Reference Element, Switch Regulator, Power Amp, Regulator $\leq 1W$, Power Amp, Regulator $> 1W$, Bipolar HF Mod, Demod PLL, VCO, CMOS HF Mod, Demod PLL, VCO, Bipolar TX/RX, CMOS TX/RX, Power Amp, Receiver
(ASIC)	ASIC Bipolar TTL, ASIC Bipolar ECL, ASIC Bipolar HV, ASIC NMOS, ASIC CMOS $< 50k$, ASIC CMOS 50k-50M, ASIC CMOS $> 50M$, CMOS, BICMOS HV $> 50V$, Non-Erasable PLD TTL, Non-Erasable PLD ECL, Non-Erasable PLD CMOS, Erasable PLD RAM, Erasable PLD EPROM, Erasable PLD EEPROM, Erasable PLD Flash-EPROM
FIT Exp	$x \geq 0.0 [1e-9]$

Parameter	Value
Top	$x \text{ in } \mathbb{R} \text{ [}^\circ\text{C]}$
Uop	$x \geq 0.0 \text{ [V]}$
Urat	$x \geq 0.0 \text{ [V]}$
FIT Ref Comp	$x \geq 0.0 \text{ [1e-9]}$
FIT Ref Def	$x \geq 0.0 \text{ [1e-9]}$

4.2 Operational

Parameter	Value
Designator	(IC U)<Num>[<Char>] (e.g. U1A)
Description	Text
FIT	$x \geq 0.0 \text{ [1e-9]}$
Type	(As in experimental)
Subtype	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 \text{ [1e-9]}$
FIT Ref Def	$x \geq 0.0 \text{ [1e-9]}$
Top	$x \text{ in } \mathbb{R} \text{ [}^\circ\text{C]}$
Uop	$x \geq 0.0 \text{ [V]}$
Urat	$x \geq 0.0 \text{ [V]}$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

4.3 Sensitivity

Type	Sensitivity
Digital > CMOS Logic, Analog SW, Bus IF	Top, Uop, Urat
Digital > CMOS Bus IF GTL	Top, Uop, Urat
Digital > CMOS Bus Driver	Top, Uop, Urat
Analog > Bipolar Opamp, Comp, V-Monitor	Top, Uop, Urat
Analog > CMOS Opamp, Comp, V-Monitor	Top, Uop, Urat
All others	Top

5 Optoelectronics

5.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Semiconductor, LED, Laser, Optocoupler, LB, Passive, Transceiver, other
Subtype	<i>Depends on Type</i>
Semiconductor	Phototransistors, Photodiode, Photo Element, Detector Module, Solar Component
LED, Laser	LED Visible, LED IRED, Laser Diode, Laser Array, Pump, Display, Optical Amp, Modulator
Optocoupler, LB	Opto Bipolar Out, Opto FET Out, Opto w/Electronics, Opto w/Power, LB w/Output, LB w/Electronics
Passive	Optical Waveguide Connector, Optical Fibre Pigtail, Fibre, Antidispersion Fibre, Isolator, Circulator, Optical Mux/Demux, Optical Attenuator, Switch, Coupler, Splitter, Filter
Transceiver, other	Transceiver, Transponder, GTC Interrupter
Material	<i>Depends on Type and Subtype</i>
(Semiconductor)	Si, InP, Ge
(LED, Laser) > (LED IRED)	(Al)GaAs, InP
(LED, Laser) > (Laser Diode)	GaAs, InP
(LED, Laser) > (Laser Array, Pump)	GaAs, InP
FIT Exp	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Iop	$x \geq 0.0 [A]$
Urat	$x \geq 0.0 [V]$
Irat	$x \geq 0.0 [A]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

5.2 Operational

Parameter	Value
Designator	(OPT0 DL LED LSR PHD LDR OPTIC OC) <Num> [<Char>] (e.g. DL1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Subtype	(As in experimental)
Material	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Uop	$x \geq 0.0 [V]$
Iop	$x \geq 0.0 [A]$
Urat	$x \geq 0.0 [V]$
Irat	$x \geq 0.0 [A]$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

5.3 Sensitivity

Type	Sensitivity
Semiconductor > Phototransistors	Top, Uop, Urat
LED, Laser > LED Visible	Top, Iop, Irat
LED, Laser > LED IRED	Top, Iop, Irat
All others	Top

6 Resistors

6.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Carbon Film, Metal Film, Deposited Thin Film, Deposited Thick Film, Networks, Metal-Oxide, Wire-Wound, Variable
FIT Exp Top	$x \geq 0.0 [1e-9]$
FIT Ref Comp	$x \text{ in } R [^{\circ}C]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

6.2 Operational

Parameter	Value
Designator	R<Num>[<Char>] (e.g. R1A)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in } R [^{\circ}C]$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

6.3 Sensitivity

Complete - all parameters are used in all cases.

7 Relays

7.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Low Current, General Purpose, Automotive, Automotive Tungsten
Load	Resistive, Capacitive, Inductive
Current	DC, AC
Coating	Au-Coating, No Au-Coating
Material	Plastic, Metal/Glass/Ceramic
FIT Exp	$x \geq 0.0 [1e-9]$
Uop	$x \geq 0.0 [V]$
Iop	$x \geq 0.0 [A]$
Top	$x \text{ in } R [^{\circ}C]$
Sop	$x \geq 0.0$
Urat	$x \geq 0.0 [V]$
Irat	$x \geq 0.0 [A]$
Tref	$x \geq 0.0 [^{\circ}C]$
Sref	$x \geq 0.0$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

7.2 Operational

Parameter	Value
Designator	(K RY RLA) <Num> [<Char>] (e.g. K1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Load	(As in experimental)
Current	(As in experimental)
Coating	(As in experimental)
Material	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

Parameter	Value
Top	$x \text{ in } \mathbb{R} \text{ [}^\circ\text{C]}$
Uop	$x \geq 0.0 \text{ [V]}$
Iop	$x \geq 0.0 \text{ [A]}$
Urat	$x \geq 0.0 \text{ [V]}$
Irat	$x \geq 0.0 \text{ [A]}$
Tref	$x \geq 0.0 \text{ [}^\circ\text{C]}$
Sref	$x \geq 0.0$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

7.3 Sensitivity

Type	Sensitivity
General Purpose	Current, Coating, Top, Uop, Urat, Iop, Irat, Tref, Sop, Sref
All others	Top, Uop, Urat, Iop, Irat, Tref, Sop, Sref

8 Switches and Push Buttons

8.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Dip Fix/Encoding Switch/Foil PB, Low Current Switch/PB, High Current Switch/PB
Load	Resistive, Capacitive, Inductive
Current	DC, AC
Coating	Au-Coating, No Au-Coating
FIT Exp	$x \geq 0.0 [1e-9]$
Top	$x \text{ in R } [^{\circ}\text{C}]$
Uop	$x \geq 0.0 [\text{V}]$
Iop	$x \geq 0.0 [\text{A}]$
Urat	$x \geq 0.0 [\text{V}]$
Irat	$x \geq 0.0 [\text{A}]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

8.2 Operational

Parameter	Value
Designator	(SW KB PB)<Num>[<Char>] (e.g. SW1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Load	(As in experimental)
Current	(As in experimental)
Coating	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Top	$x \text{ in R } [^{\circ}\text{C}]$
Uop	$x \geq 0.0 [\text{V}]$
Iop	$x \geq 0.0 [\text{A}]$

Parameter	Value
Urat	$x \geq 0.0$ [V]
Irat	$x \geq 0.0$ [A]
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

8.3 Sensitivity

Type	Sensitivity
Dip Fix/Encoding Switch/Foil PB, Low Current Switch/PB	None
Low Current Switch/PB	Load, Uop, Iop, Urat, Irat
High Current Switch/PB	Load, Current, Coating, Uop, Iop, Urat, Irat
All others	Top



9 Lamps

9.1 Experimental

Parameter	Value
Key	Text
Description	Text
Type	Signal, Pilot, Railway-Signaling, LV Traffic Lamp, Halogen, HV Traffic Lamp, Glow Lamp
FIT Exp	$x \geq 0.0 [1e-9]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$

9.2 Operational

Parameter	Value
Designator	LAMP<Num>[<Char>] (e.g. LAMP1)
Description	Text
FIT	$x \geq 0.0 [1e-9]$
Type	(As in experimental)
Key	Text
FIT Ref Comp	$x \geq 0.0 [1e-9]$
FIT Ref Def	$x \geq 0.0 [1e-9]$
Uop	$x \geq 0.0 [V]$
Urat	$x \geq 0.0 [V]$
Profile	None, Dormancy, Complex
Dormant Ratio	$0 \leq x \leq 1$
Dormant Factor	$0 \leq x \leq 1$

9.3 Sensitivity

Complete - all parameters are used in all cases.