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MOTOROLA

MC33465

Micropower Undervoltage Sensing Circuits with Programmable Output Delay

The MC33465 series are micropower undervoltage sensing circuits that are specifically designed for use with battery powered microprocessor based systems, where extended battery life is required. A choice of several threshold voltages from 0.9 V to 4.5 V are available. This device features a very low quiescent bias current of 1.0 μA typical.

The MC33465 series features a highly accurate voltage reference, a comparator with precise thresholds and built–in hysteresis to prevent erratic reset operation, a choice of output configurations between open drain or complementary, a time delayed output, which can be programmed by the system designer, and guaranteed operation below 1.0 V with extremely low standby current. This device is available in a SOT–23 5–pin surface mount package.

Applications include direct monitoring of the MPU/logic power supply used in appliance, automotive, industrial and portable equipment.

MC33465 Features:

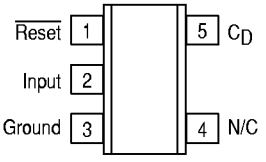
- Extremely Low Standby Current of 1.0 μA at V_{in} = 3.5 V
- Wide Input Voltage Range (0.7 V to 10 V)
- Monitors Power Supply Voltages from 1.1 V to 5.0 V
- High Accuracy Detector Threshold (±2.5%)
- Two $\overline{\text{Reset}}$ Output Types (Open Drain or Complementary Drive)
- Programmable Output Delay by External Capacitor (100 ms typ. with 0.15 μF)
- Surface Mount Package (SOT–23 5–Pin)
- Convenient Tape and Reel (3000 per Reel)

MICROPOWER UNDERVOLTAGE SENSING CIRCUITS WITH PROGRAMMABLE OUTPUT DELAY

SEMICONDUCTOR TECHNICAL DATA

N SUFFIX
PLASTIC PACKAGE
CASE 1212
(SOT–23)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Threshold Voltage	Type	Operating Temperature Range	Package
MC33465N–09ATR	0.9	Open Drain $\overline{\text{Reset}}$	T_A = –40° to +85°C	SOT–23
MC33465N–20ATR	2.0			
MC33465N–27ATR	2.7			
MC33465N–30ATR	3.0			
MC33465N–45ATR	4.5			
MC33465N–09CTR	0.9	Compl. MOS $\overline{\text{Reset}}$		
MC33465N–20CTR	2.0			
MC33465N–27CTR	2.7			
MC33465N–30CTR	3.0			
MC33465N–45CTR	4.5			

Other voltages from 0.9 to 6.0 V, in 0.1 V increments, are available. Consult factory for information.

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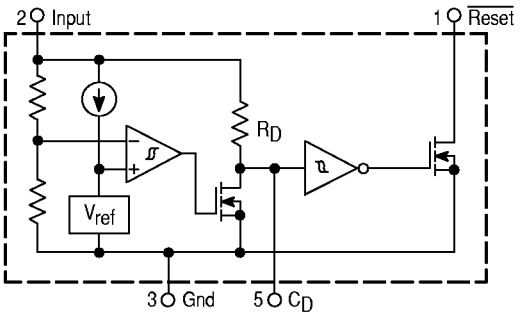
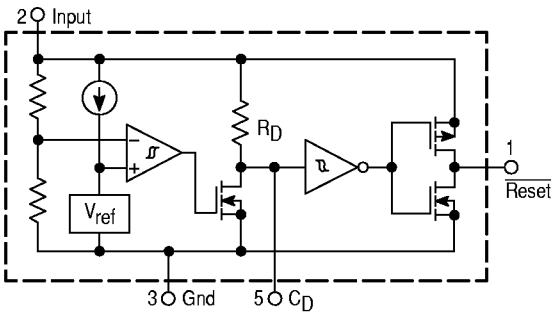
Representative Block Diagrams

MC33465N–YYATR
Open Drain Output Configuration



MC33465N–YYCTR
Complementary Output Configuration



YY Denotes Threshold Voltage

This device contains 28 active transistors.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Input Supply Voltage	V_{in}	0 to 12	V
$\overline{\text{Reset}}$ Output Voltage	V_O	–0.3 to 12	V
$\overline{\text{Reset}}$ Output Current (Source or Sink)	I_O	70	mA
Power Dissipation and Thermal Characteristics Maximum Power Dissipation at T_A = 25°C Case 1212 (SOT–23) N Suffix Thermal Resistance, Junction–to–Ambient	 P_D $R_{\theta JA}$	 150 667	 mW °C/W
Operating Junction Temperature	T_J	+125	°C
Operating Ambient Temperature	T_A	–40 to +85	°C
Storage Temperature Range	T_{stg}	–40 to +125	°C
Lead Temperature (Soldering)	T_{solder}	260°C, 10 s	

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C (Note 1), unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
SENSE COMPARATOR					
Threshold Voltage					V
High to Low State Output (V_{in} Decreasing)	V_{IL}				
09 Suffix		0.878	0.9	0.922	
18 Suffix		1.755	1.8	1.845	
27 Suffix		2.633	2.7	2.767	
36 Suffix		3.51	3.6	3.69	
45 Suffix		4.387	4.5	4.612	
Threshold Hysteresis (V_{in} Increasing)	V_H				V
09 Suffix		0.027	0.045	0.063	
18 Suffix		0.054	0.09	0.126	
27 Suffix		0.081	0.135	0.189	
36 Suffix		0.108	0.18	0.252	
45 Suffix		0.135	0.225	0.315	
Threshold Voltage Temperature Coefficient	T_C	–	±100	–	PPM/°C
$\overline{\text{RESET}}$ OUTPUT					
Output Voltage					V
High State (Complementary Output: I_{source} = 1.0 mA)	V_{OH}	V_{in} – 2.1	V_{in} – 1.0	V_{in}	
Low State (Complementary or Open Drain Output: I_{sink} = 1.0 mA)	V_{OL}	–	0.25	0.5	
Output Sink Current (V_{in} = 1.5 V, V_{OL} = 0.5 V)	I_{OL}	1.0	2.0	–	mA
Output Source Current (V_{in} = 4.5 V, V_{OH} = 2.4 V)	I_{OH}	1.0	2.0	–	mA
DELAY OUTPUT					
Output Sink Current (V_{in} = 1.5 V, V_{OL} = 0.5 V)	I_{OL}	0.2	0.8	–	mA
Delay Resistance	R_D	0.5	1.0	2.0	MΩ
TOTAL DEVICE					
Operating Input Voltage Range	V_{in}	0.8 to 10	–	–	V
Quiescent Input Current	I_{in}				μA
V_{in} = 4.34 V		–	5.5	11	
V_{in} = 6.50 V		–	1.3	3.9	

NOTE: 1. Low duty pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

Figure 1. $\overline{\text{Reset}}$ Low State Sink Current versus Output Voltage

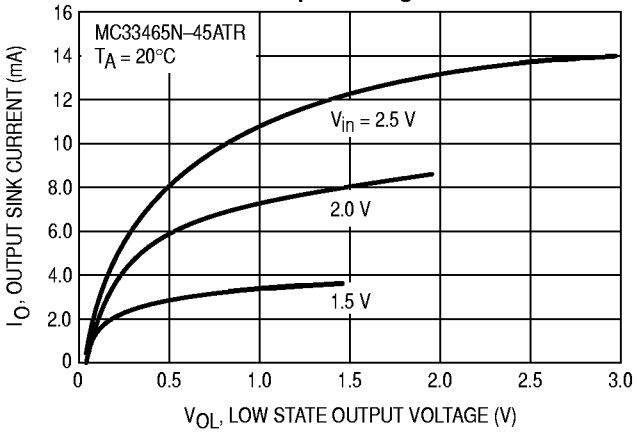


Figure 2. Output Voltage versus Input Voltage

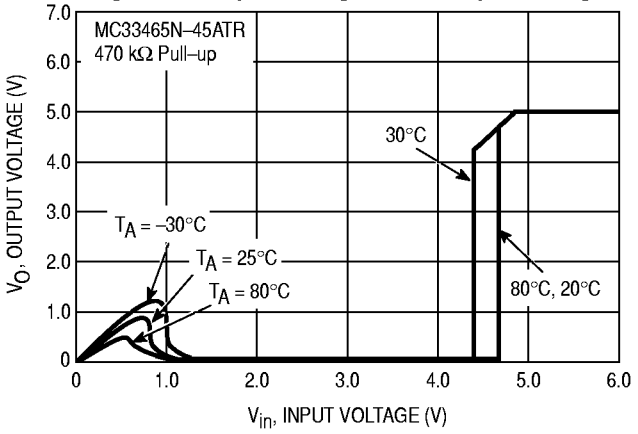


Figure 3. Input Current versus Input Voltage

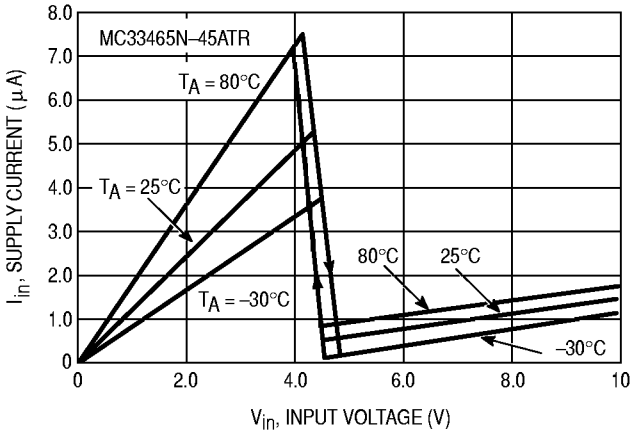


Figure 4. Comparator Input Threshold Voltage versus Temperature

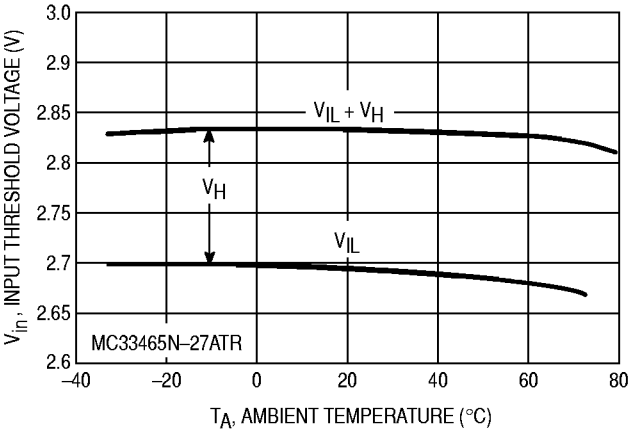


Figure 5. $\overline{\text{Reset}}$ Output Sink Current versus Input Voltage

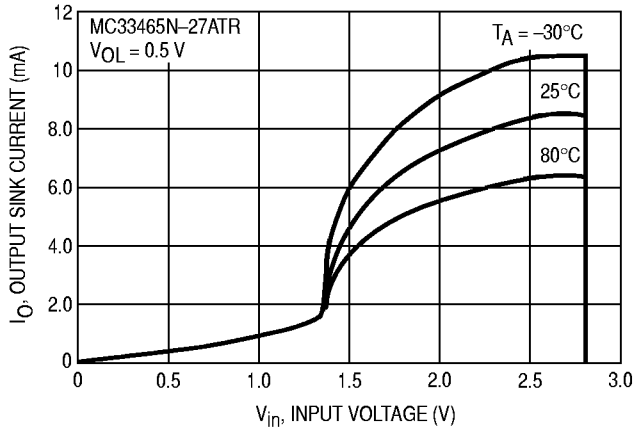


Figure 6. $\overline{\text{Reset}}$ Output Source Current versus Input Voltage

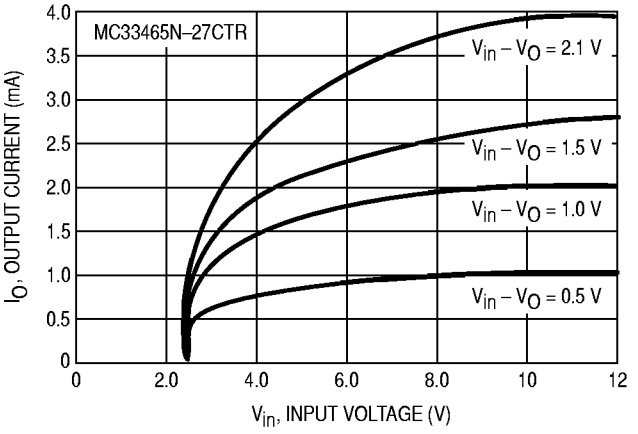


Figure 7. C_D Sink Current versus Input Voltage

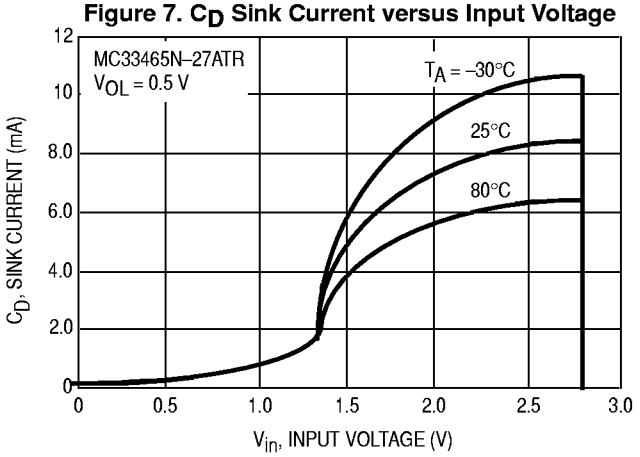


Figure 8. C_D Sink Current versus C_D Voltage

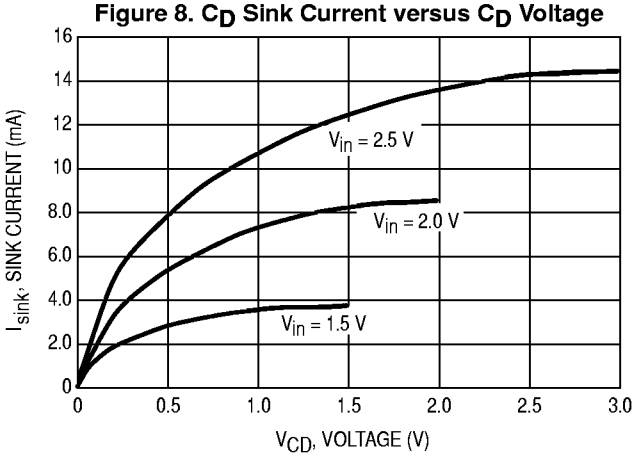


Figure 9. Delay Resistance versus Temperature

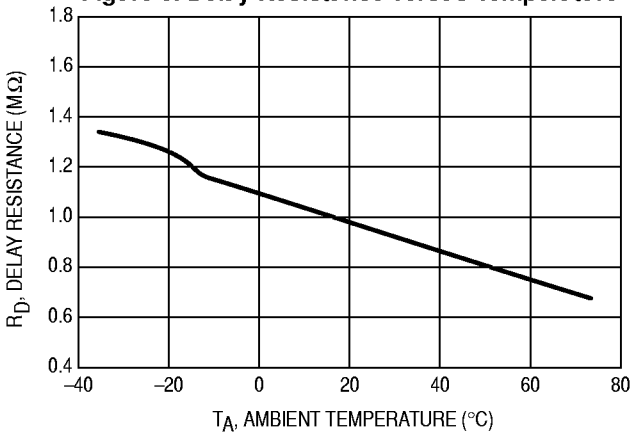


Figure 10. Detector Threshold versus Temperature

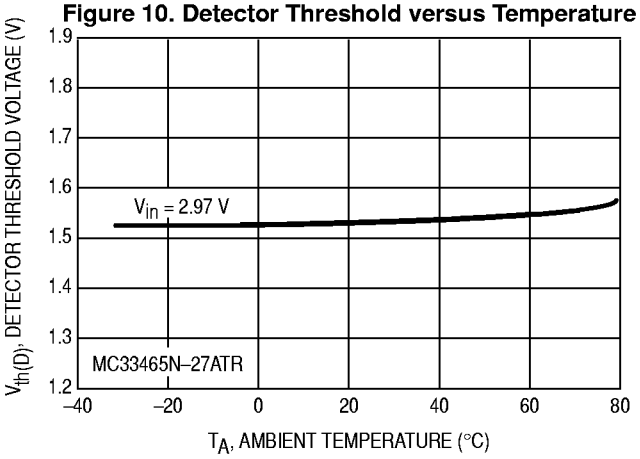


Figure 11. Output Delay Time versus Delay Capacitance

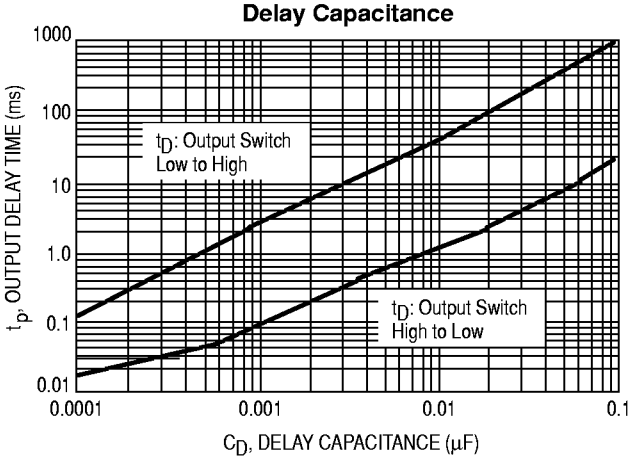


Figure 12. Typical Open Drain Application

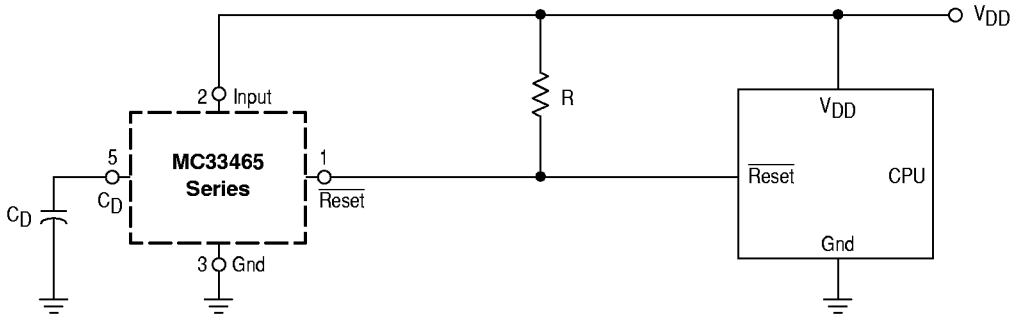
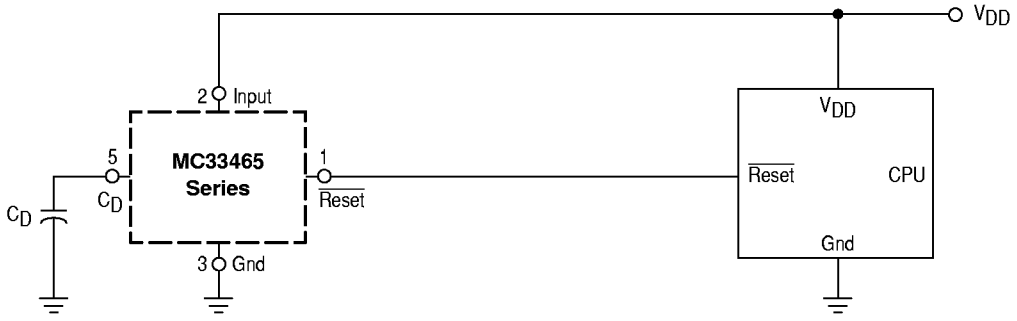


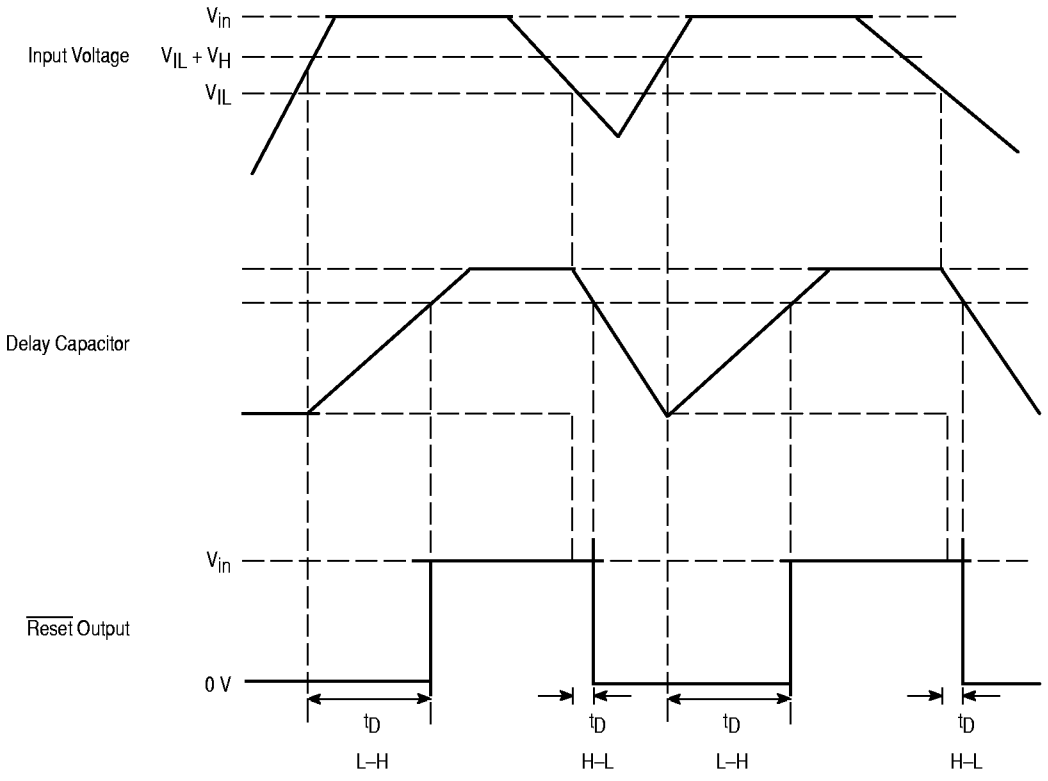
Figure 13. Typical Complementary Output Application



APPLICATION CIRCUIT INFORMATION

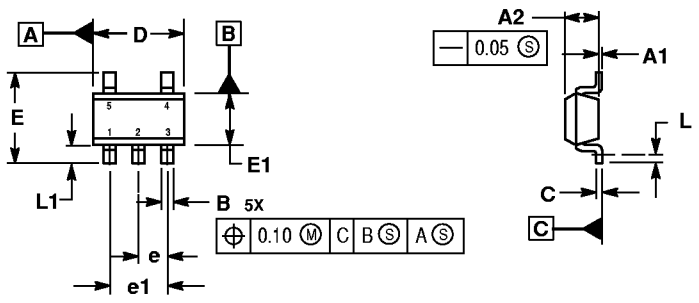
The MC33465 series are micropower undervoltage sensing circuits which offer a programmable time delayed output with the choice of either complementary output drive or open drain output configurations. Figure 14 shows the timing relationships between the input voltage and the resulting circuit waveforms. When the input voltage (V_{in}) exceeds the sense comparator threshold, the timing capacitor is allowed to charge through the internal delay resistor. When the output inverting driver threshold is exceeded, the $\overline{\text{Reset}}$ output switches from a logic “0” to a logic “1”. The top curve of Figure 11 provides the nominal delay time for a given value of delay capacitance. When V_{in} drops below the comparator threshold minus hysteresis voltage, the delay capacitor discharges. When the capacitance voltage drops below the inverting drive threshold, the output switches from a logic “1” to a logic “0”. The bottom curve in Figure 11 provides typical delay time for given delay capacitance values. The inverting driver threshold voltage is typically about $V_{in}/2$, as shown in Figure 10.

Figure 14. Timing Waveforms



OUTLINE DIMENSIONS

N SUFFIX
PLASTIC PACKAGE
CASE 1212–01
(SOT–23)
ISSUE O



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DATUM C IS A SEATING PLANE.

	MILLIMETERS	
DIM	MIN	MAX
A1	0.00	0.10
A2	1.00	1.30
B	0.30	0.50
C	0.10	0.25
D	2.80	3.00
E	2.50	3.10
E1	1.50	1.80
e	0.95 BSC	
e1	1.90 BSC	
L	0.20	—
L1	0.45	0.75

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