DEDICATED INFRARED RECEIVER

FEATURES

- **Highly Integrated Device with No External Components except PIN Diode**
- **High Sensitivity due to Adaptive Gain Control**
- **High Immunity Against Interference from Ambient Light**
- **Available for Carrier Frequencies of 33kHz, 36kHz, 38kHz, 40kHz, 56kHz**
- **Wide Supply Voltage Range: 2.7V to 5.5V**
- **TTL Compatible**
- **Compatible with Popular IR Coding Protocol such as: NEC, RC5 and Sony etc.**

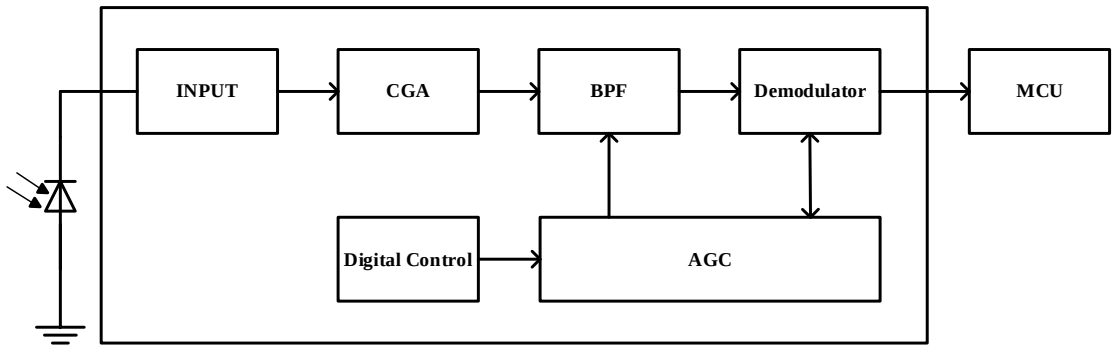
APPLICATIONS

- **Home Entertainment Applications**
- **Remote Control Equipment**
- **Home Appliances**

PRODUCT DESCRIPTION

TS3112 is a complete IR receiver for use in carrier-frequency-modulated transmission applications. The IC combines small size with high sensitivity as well as high suppression of interference from daylight and lamps. TS3112 operates in a supply voltage range of 2.7V to 5.5V, and is available with standard frequencies (33, 36, 38, 40, 56kHz). The function of TS3112 is described using the block diagram of Figure 1. The IC contains input stage IV conversion circuit, variable gain VGA, bandpass filter BPF, integral demodulation circuit and output stage circuit. The input stage has two main functions: first, it provides a suitable bias voltage for the PIN diode; second, the pulsed photo current signals are transformed into a voltage.

The signals have to pass a Controlled Gain Amplifier (CGA), and then pass a bandpass filter (BPF) with a center frequency, which is equal to the carrier frequency. The demodulator converts the input burst signal to a digital envelope output pulse. The output stage provides a certain drive capability. The analog control loop circuit and the Controlled Gain Amplifier can realize that the chip can always keep the most sensitive state in any case, which means the chip always stays above the noise state. Once the signal is sent, it will be immediately received and demodulated.



ORDERING INFORMATION

Product Model	Period	Carrier Frequency	Best choice for	Ecology Plan	Package Type
TS3112-33	Production	33 kHz		RoHS	Dice
TS3112-36	Production	36 kHz	RC-5	RoHS	Dice
TS3112-38	Production	38 kHz	NEC	RoHS	Dice
TS3112-40	Production	40 kHz	Sony	RoHS	Dice
TS3112-56	Production	56 kHz		RoHS	Dice

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted) (1)

Parameter	Min	Max	Unit
Supply Voltage	-0.3	6	V
Output Voltage	-0.3	V_{DD}	V
Output Current	8	-	mA
Operating Temperature	-25	85	˚C
Storage Temperature	-40	125	˚C
ESD HBM		±4000	V

(1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device.
Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS, 3V OPERATION

At **T_A = –25℃ to +85℃**, V_S = 2.7V to 3.3V (unless otherwise specified)

Parameters		Test Conditions	Min	Typ	Max	Unit
Supply						
V_S	Supply-Voltage Range		2.7	3	3.3	V
I_S	Supply Current	I_{IN} = 0		0.53		mA
Output						
R_{PU}	Internal Pull-Up Resistor	T_A = 25℃		37		kΩ
V_{OL}	Output Voltage Low	external pull-up resistor is 1.4kΩ			122	mV
V_{OH}	Output Voltage High		V_S - 0.05		V_S	V
I_{OCL}	Output Current Clamping			7.6		mA
Input						
V_{IN_DCMIN}	Input DC Voltage	I_{IN} = -150μA, V_S = 2.7V, measure V_{IN}	0			V
I_{IN_DCMAX}	Input DC Current	V_{IN} = 0, V_S = 3V, T_A = 25℃		285		μA
I_{Eemin}	Minimum Detection Threshold Current	V_S = 3V, I_{IN_DC} = 1μA, T_A = 25℃, burst N = 22, f = f_0		0.95		nA
Controlled Amplifier and Filter						
G_{VARMAX}	Maximum Value of Variable Gain (CGA)	V_S = 3V, T_A = 25℃		70		dB
G_{VARMIN}	Minimum Value of Variable Gain (CGA)	V_S = 3V, T_A = 25℃		-9		dB
G_{MAX}	Total Internal Amplification (VGA + BPF)	V_S = 3V, T_A = 25℃		88		dB
f_{03V_FUSE}	Center Frequency Fusing Accuracy of Bandpass	V_S = 3V, T_A = 25℃, 0.5% accuracy	-2.5	f_0	2.5	%
f_{03V}	Overall Accuracy Center Frequency of Bandpass		-4.3	f_0	3.2	%
BW	BPF Bandwidth	-3dB, f_0 = 38kHz		4		kHz

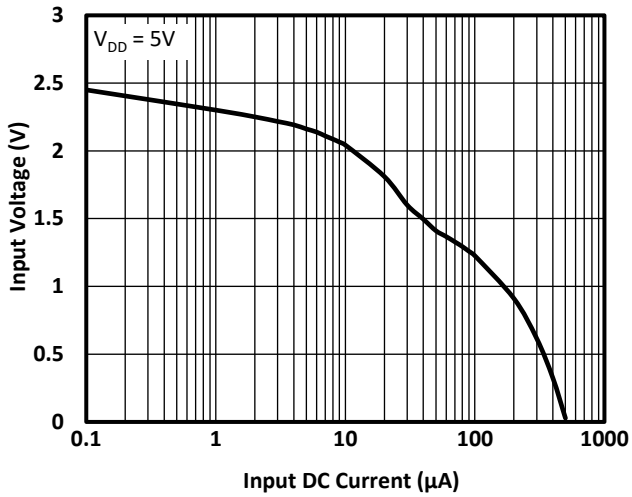
ELECTRICAL CHARACTERISTICS, 5V OPERATION

At **T_A = –25℃ to +85℃**, V_S = 4.5V to 5.5V (unless otherwise specified)

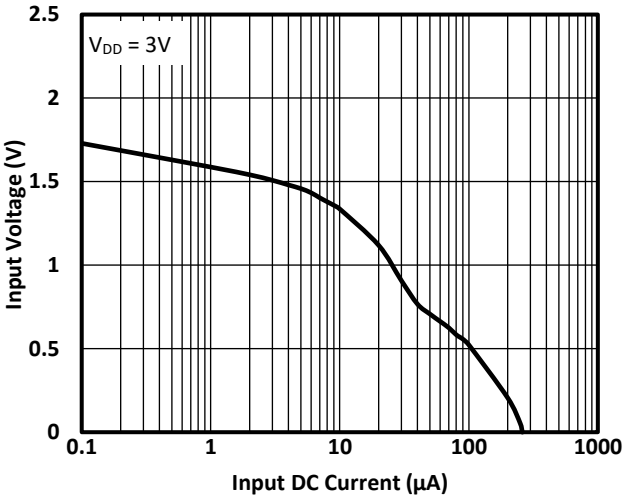
Parameters		Test Conditions	Min	Typ	Max	Unit
Supply						
V_S	Supply-Voltage Range		4.4	5	5.5	V
I_S	Supply Current	I_{IN} = 0		0.6		mA
Output						
R_{PU}	Internal Pull-Up Resistor	T_A = 25℃		37		kΩ
V_{OL}	Output Voltage Low	external pull-up resistor is 1.4kΩ			125	mV
V_{OH}	Output Voltage High		V_S - 0.125		V_S	V
I_{OCL}	Output Current Clamping			7.6		mA
Input						
I_{IN_DCMAX}	Input DC Current	V_{IN} = 0, V_S = 4.5V	400			μA
		V_{IN} = 0, V_S = 4.5V, T_A = 25℃		530		
I_{Eemin}	Minimum Detection Threshold Current	V_S = 5V, I_{IN_DC} = 1μA, T_A = 25℃, burst N = 16, f = f_0		0.92		nA
Controlled Amplifier and Filter						
G_{VARMAX}	Maximum Value of Variable Gain (CGA)	V_S = 5V, T_A = 25℃		70		dB
G_{VARMIN}	Minimum Value of Variable Gain (CGA)	V_S = 5V, T_A = 25℃		-9		dB
G_{MAX}	Total Internal Amplification (VGA+BPF)	V_S = 5V, T_A = 25℃		88		dB

TYPICAL ELECTRICAL CURVES (at T_A = 25℃)

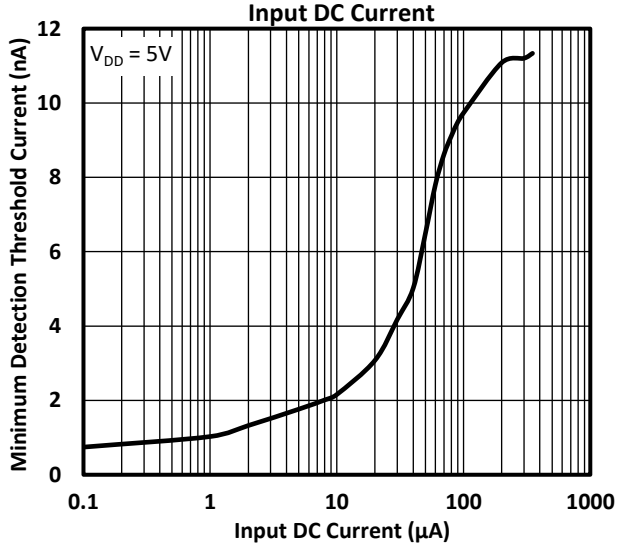
Input Voltage vs Input DC Current



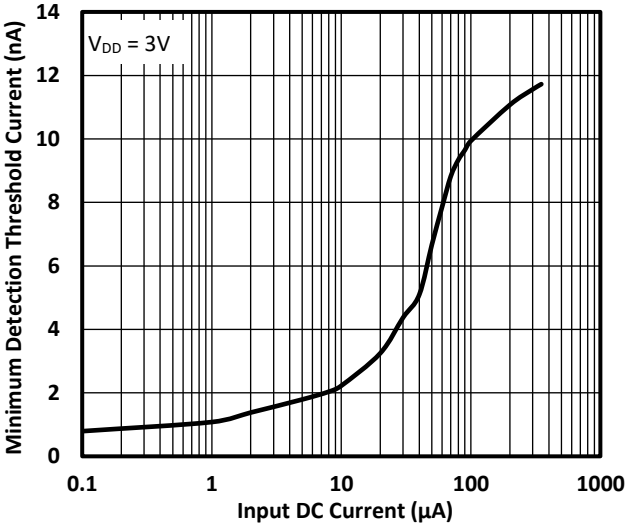
Input Voltage vs Input DC Current



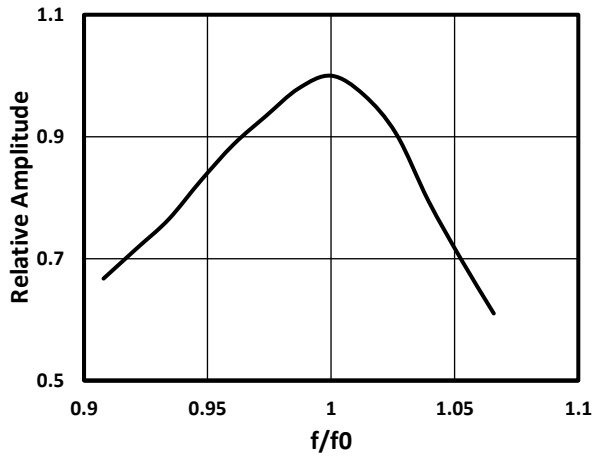
Minimum Detection Threshold Current vs Input DC Current



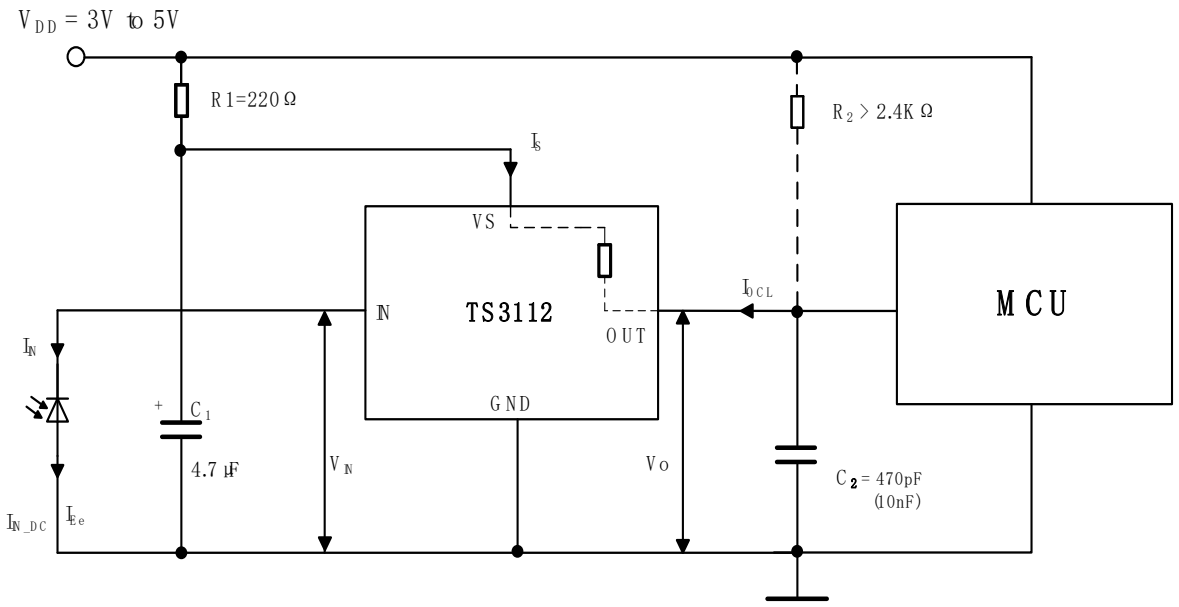
Minimum Detection Threshold Current vs Input DC Current



Bandpass



APPLICATION CIRCUIT



DATA SIGNAL LIMITATION

Symbol	Parameter	TS3112
T_{Burst_Min}	Minimum Burst Length	10 cycles/burst
T_{Gap_Min}	For bursts greater than a minimum gap time is required of	10 cycles ≥12 cycles
N_{BPS_Max}	Maximum number of continuous short bursts/second	2000
t_{ON}	Turn-on Propagation Delay	8 to 12 cycles
t_{OFF}	Turn-off Propagation Delay	8 to 12 cycles

Data Signal diagram

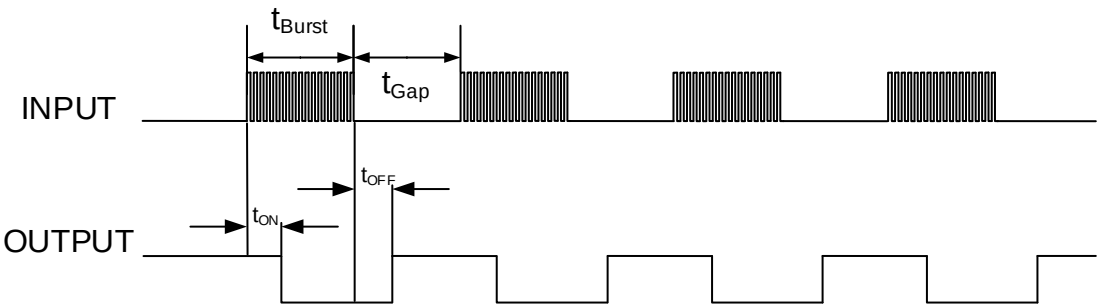
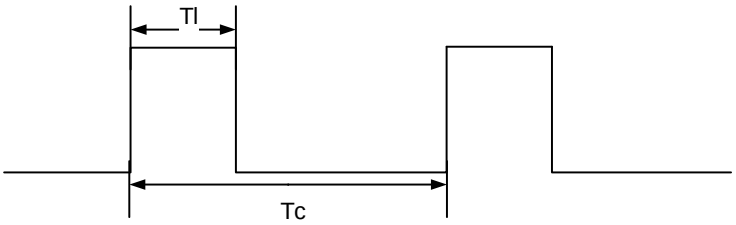


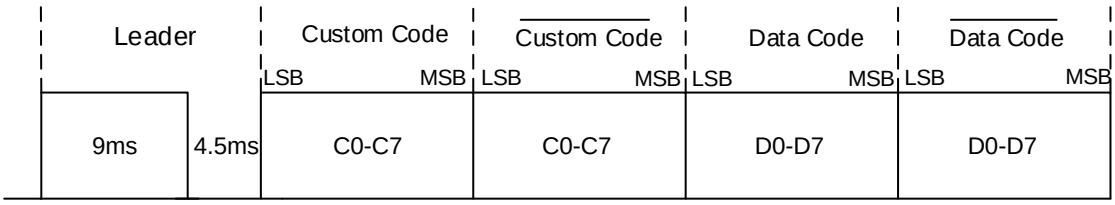
ILLUSTRATION OF NEC

Carrier frequency = 38kHz

Duty ratio = 1/3



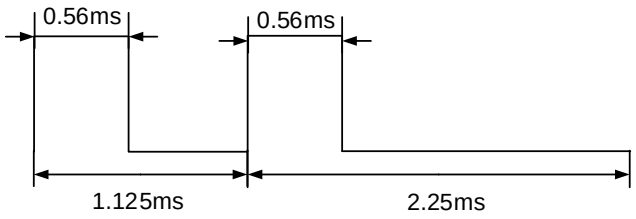
Configuration of Flame



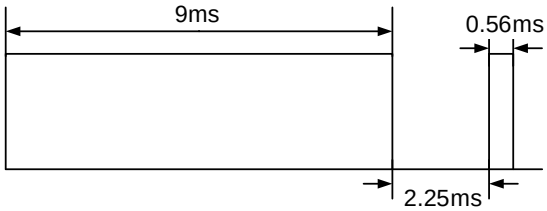
Bit discription

Bit "0"

Bit "1"



Repeat Code



Flame interval: Tf

The transmitted waveform as long as a key is depressed

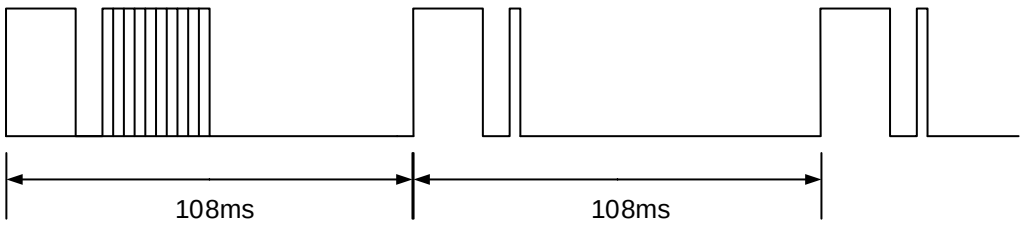
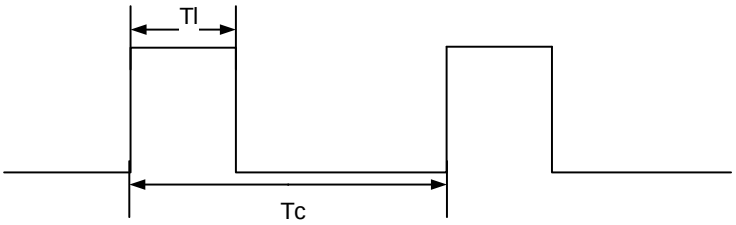
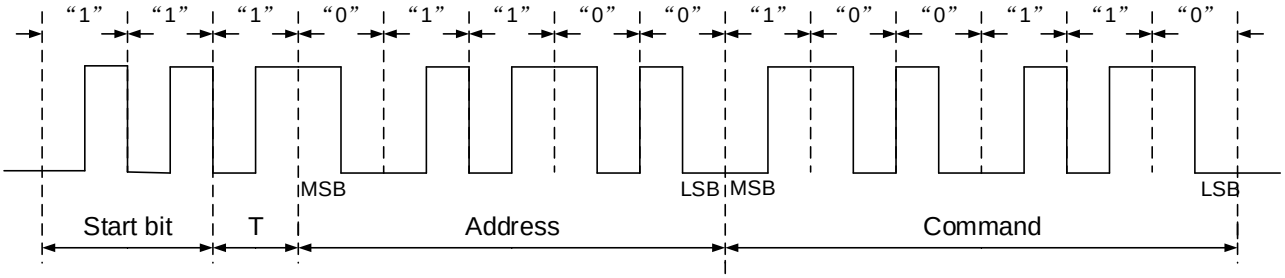


ILLUSTRATION OF RC-5

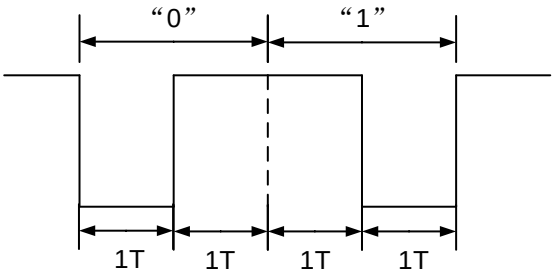
Carrier frequency = 38kHz

Duty ratio = 1/3





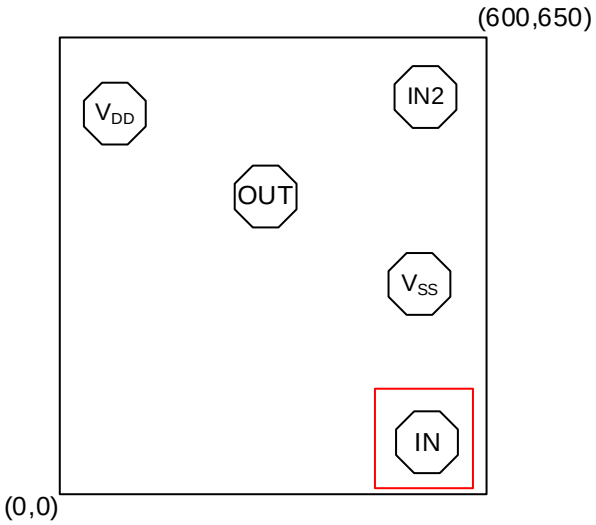
T = 0.889ms



DIE INFORMATION

1) Logo: IC2024
2) Die Size: 600um x 650um (not including trimming pad)
3) hip Size: 680um x 730um (including scribe line)
4) Scribe Line: 80um
5) Pad Opening Size: 80um x 80um (bond pad), 50um x 50um (test pad)
6) Pad Location:

PAD NAME	x	y
IN	519.000	63.000
VSS (GND)	509.000	294.000
OUT	292.000	423.000
IN2	519.000	569.000
VDD (V_{CC})	75.000	542.000



Note: The pad coordinates are given for the center of the pad, values in μm from the origin (0,0). Chip die size is 600um x 650um.

REVISION HISTORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

2020/6/12—REV KY1.0.2A to REV KY1.0.3A

Added ESD CAUTION……2

Updated ORDERING INFORMATION……2

Updated ELECTRICAL CHARACTERISTICS, 3V OPERATION (Test Conditions) ……3

Updated ELECTRICAL CHARACTERISTICS, 5V OPERATION (Test Conditions) ……4

Updated ILLUSTRATION OF USED TERMS (NEC code logic: “0” for example) ……6

2020/7/29—REV KY1.0.3A to REV KY1.1.3A

Remove DATA SIGNAL LIMITATION from ELECTRICAL CHARACTERISTICS……3

Added ILLUSTRATION OF USED TERMS ……8

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