RJR710xx-Q
High Voltage Low-Dropout Regulator

Key Features

- AEC-Q100 qualified for automotive applications
  - Temperature grade 1: -40℃ to 125℃, T_A
- Device junction temperature range
  - -40℃ to 175℃, T_J
- 3 V to 40 V wide input voltage range with up to 42 V transient
- Maximum output current: 150mA
- Low quiescent current
  - 800 nA typical when EN = low (shutdown)
  - 5.5 uA typical at light loads
  - 7.0 uA maximum at light loads
- 2% output-voltage accuracy over line, load and temperature
- Typical dropout voltage: 300 mV at 150 mA load current for 5 V output version
- Stable with low-ESR (0.001Ω to 5Ω) ceramic output-stability capacitor (1uF to 200uF)
- Fixed 5 V,3.3 V output voltage
- Integrated fault protection
  - Over Temperature Protection
  - Over Current Protection
- Package Options
  - SOP8-EP
  - DFN8-3x3
  - SOT223-4

Applications

- Applications with direct battery connection
- Infotainment
- Dashboard
- Body control module

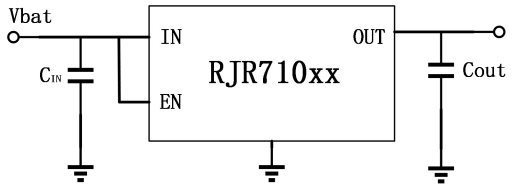
Description

The RJR710 series is a low-dropout linear regulator designed for up to 40 V V_{IN} applications. With only a 5.5 µA typical quiescent current at light load, the device is an optimal solution for powering micro-controllers and controller area network and local interconnect network transceivers in standby systems. The device features integrated short-circuit and over current protection. This device operates in ambient temperatures from –40°C to +125°C.

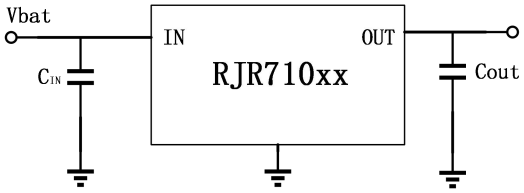
Device Information

Part Number	*Output voltage*	*Package*
RJR71050-QHSPR	5.0V	SOP8-EP
RJR71050-QDNR	5.0V	DFN8-3x3
RJR71050-QSTBR	5.0V	SOT223-4
RJR71033-QHSPR	3.3V	SOP8-EP
RJR71033-QDNR	3.3V	DFN8-3x3
RJR71033-QSTBR	3.3V	SOT223-4

Typical Application



SOP8/DFN8 Typical Application Circuit



SOT223 Typical Application Circuit

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1 Pin Configuration and Functions

1.1 SOP8-EP

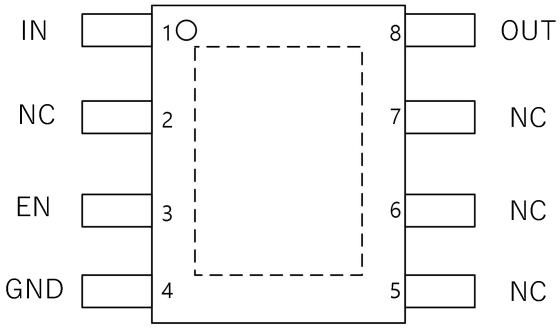


Figure 1 SOP8-EP, Pin-out, Top View

PIN NO.	SYMBOL	FUNCTION
1	IN	Power supply pin.
2,5,6,7	NC	Not connected.
3	EN	Enable.
4	GND	Ground reference.
8	OUT	Regulated output voltage pin.

1.2 DFN8-3x3

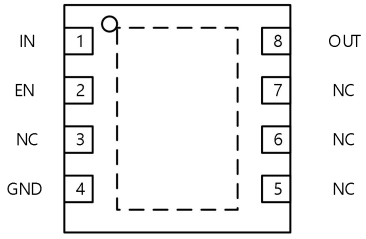


Figure 2 DFN8-3X3, Pin-out, Top View

PIN NO.	SYMBOL	FUNCTION
1	IN	Power supply pin.
2	EN	Enable.
3,5,6,7	NC	Not connected.
4	GND	Ground reference.
8	OUT	Regulated output voltage pin.

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1.3 SOT223-4

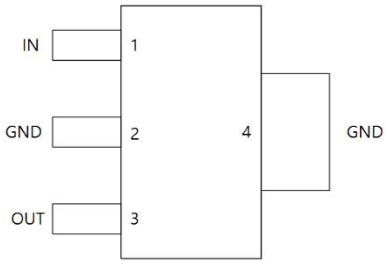


Figure 3 SOT223-4, Pin-out, Top View

PIN NO.	SYMBOL	FUNCTION
1	IN	Power supply pin.
3	OUT	Regulated output voltage pin.
2, 4	GND	Ground reference.

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2 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
V_{IN}	Unregulated input	-0.3	42	V
V_{EN}	Enable input	-0.3	V_{IN}	V
V_{OUT}	Regulated output	-0.3	7	V
T_J	Junction temperature range	-40	150	℃
T_{stg}	Storage temperature range	-40	150	℃

3 ESD Ratings

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model	AEC Q100-002	±4	kV
CDM	Charged Device Model	AEC Q100-011	±750	V

4 Recommended Operating Conditions

Symbol	Parameter	Min	Typ.	Max	Unit
V_{IN}	Unregulated input	3		40	V
V_{EN}	Enable input	0		V_{IN}	V
C_{OUT}	Output Capacitor Requirements	1		200	μF
ESR	Output Capacitor ESR Requirements	0.001		5	Ω
T_A	Ambient Temperature Range	-40		125	℃
T_J	Junction temperature range	-40		175	℃

5 Thermal Information

5.1 Thermal Information in SOP8-EP Package

Symbol	Parameter	Value	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	45.0	℃/W
$R_{\theta JB}$	Junction-to-board thermal resistance	42.0	℃/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	88.8	℃/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	10.7	℃/W

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6 Electrical Characteristics

6.1 Electrical Characteristics

All test conditions: V_{IN} = 13.5 V, T_A = -40 to +125°C. Unless otherwise noted, typical value is at T_A = 25℃.

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
Supply Input Voltage and Current						
V_{IN}	Input Supply Voltage Range		3		40	V
UVLO	V_{IN} Under-Voltage Lockout Threshold	V_{IN} rising, V_{EN} = 2 V, I_{OUT} = 150 mA		2.8	3.0	V
	Hysteresis			200		mV
I_{SD}	Shutdown Current	V_{EN} = 0 V		0.8	4.0	μA
I_Q	Quiescent Current	I_{OUT} = 0 mA		5.5	7.0	μA
		I_{OUT} = 0.1 mA		6.0	7.5	μA
Enable Input Voltage and Current						
$V_{IH,EN}$	EN Logic Input High (Enable)		1.4		V_{IN}	V
$V_{IL,EN}$	EN Logic Input Low (Disable)		0		0.4	V
I_{EN}	EN Pin Leakage Current	V_{EN} = 1.4 V to 40 V			200	nA
Regulated Output Voltage and Current						
V_{OUT_ERR}	Output Accuracy	V_{IN} = 6 V to 40 V, I_{OUT} = 1 mA to 150 mA	-2%		2%	
V_{Line_Reg}	Line Regulation	V_{IN} = 6 V to 40 V, I_{OUT} = 10 mA		5	10	mV
V_{Load_Reg}	Load Regulation	I_{OUT} = 1 mA to 150 mA		30	60	mV
V_{DO}	Dropout Voltage	I_{OUT} = 150 mA, V_{OUT} = 3.3V		300	500	mV
		I_{OUT} = 150 mA, V_{OUT} = 5V		300	500	mV
I_{OUT}	Output Current Range	V_{OUT} in regulation	0		150	mA
I_{CL}	Output Current Limit	V_{OUT} is forced to 0.9*V_{OUT}(NOM)	160	200	300	mA
t_{SU}	Start-Up Time	R_{LOAD}=500Ω, V_{OUT} = 5V, C_{OUT}=22μF, V_{OUT} from 10% to 90%		1.2		ms
PSRR	Power supply ripple rejection	V_{Ripple_pp} = 0.5 V, I_{OUT} = 10 mA, Frequency = 100 Hz, C_{OUT} = 2.2 uF		60		dB
		V_{Ripple_pp} = 0.5 V, I_{OUT} = 10 mA, Frequency = 1 kHz, C_{OUT} = 2.2 uF		40		dB
Temperature Range						
T_{SD}	Device thermal shutdown temperature			175		℃
T_{HYST}	Device thermal shutdown temperature hysteresis			20		℃

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6.2 Typical characteristics

At T_A =-40℃ to +125℃,V_{IN}=13.5V,and V_{EN}>2V （unless otherwise noted)

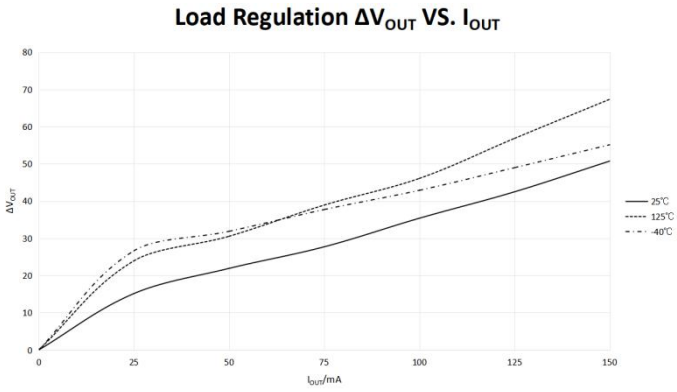


Figure 1. Load Regulation ΔV_{OUT} VS. I_{OUT}

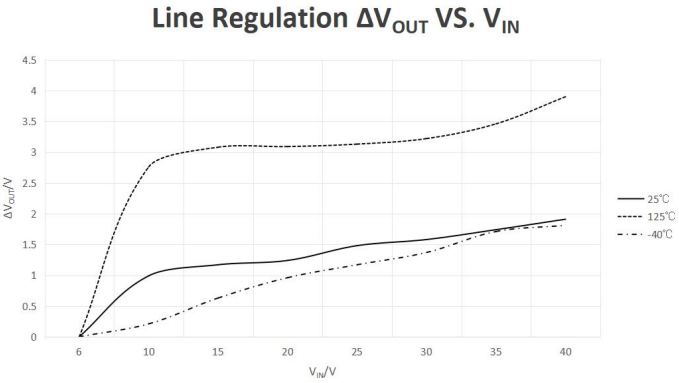


Figure 2. Line Regulation ΔV_{OUT} VS. V_{IN}

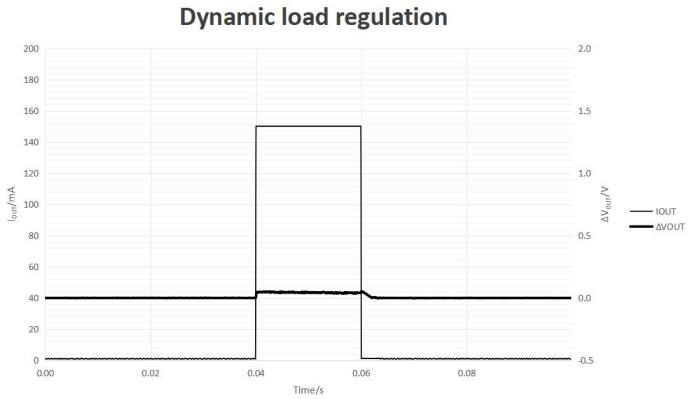


Figure 3. Dynamic load regulation

V_{OUT} = 5V , C_{IN} = 1uF , C_{OUT} = 1uF , I_{OUT} = 1mA~150mA~1mA

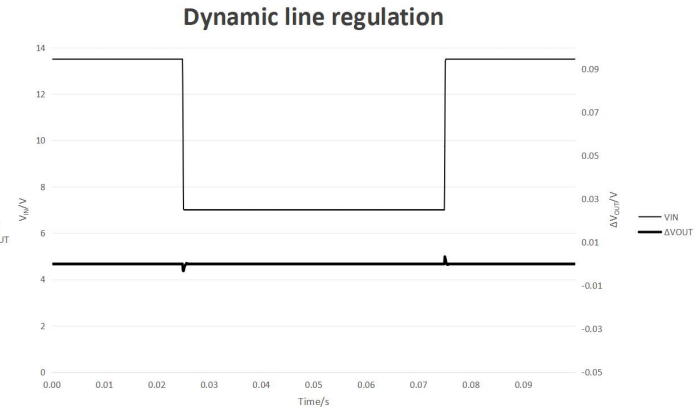


Figure 4. Dynamic line regulation

V_{OUT} = 5V , C_{IN} = 0uF , C_{OUT} = 10uF , V_{IN} = 13.5V~7.5V~13.5V

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7 Detailed Description

7.1 Overview

The RJR710 series is a 40V, 150mA, low-dropout linear regulator with ultralow quiescent current. This voltage regulator consumes only 6.0 µA of quiescent current at light load, and is quite suitable for the automotive application.

7.2 Block Diagram

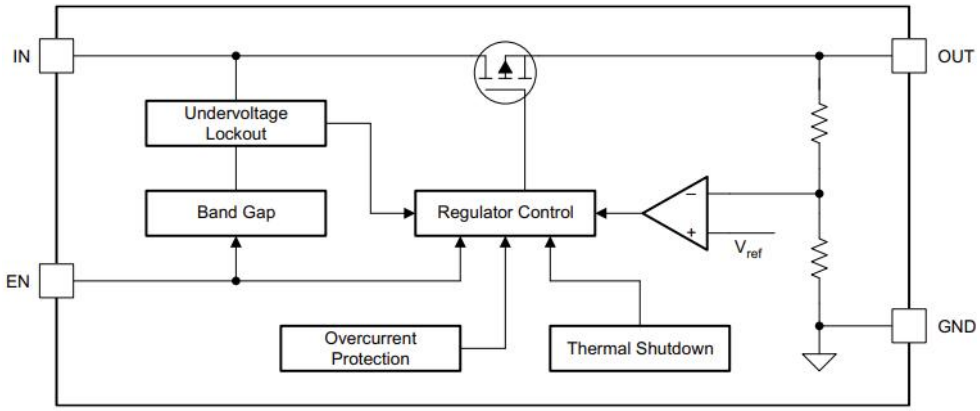


Figure 3 function block diagram

7.3 Feature Description

7.3.1 Device Enable

The EN pin is a high-voltage-tolerant pin. A high input activates the device and turns the regulation on. Connect this pin to an external micro-controller or a digital circuit to enable and disable the device, or connect to the IN pin for self-bias applications.

7.3.2 Under voltage Shutdown

This device has an integrated under voltage lockout (UVLO) circuit to shut down the output if the input voltage (V_{IN}) falls below an internal UVLO threshold (V_{UVLO}). This feature ensures that the regulator does not latch into an unknown state during low-input-voltage conditions. If the input voltage has a negative transient that drops below the UVLO threshold and recovers, the regulator shuts down and powers up with a normal power-up sequence when the input voltage is above the required level.

7.3.3 Current Limit

This device features current-limit protection to keep the device in a safe operating area when an overload or output short-to-ground condition occurs. This feature protects the device from excessive power dissipation. For example, during a short-circuit condition on the output, the fault protection limits the current through the pass element to I_{Limit} to protect the device from excessive power dissipation.

7.3.4 Thermal Shutdown

This device incorporates a thermal shutdown (T_{SD}) circuit as protection from overheating. For continuous normal operation, the junction temperature must not exceed the T_{SD} trip point. If the junction temperature

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exceeds the T_{SD} trip point, the output turns off. When the junction temperature falls below the T_{SD} trip point minus the thermal shutdown hysteresis, the output turns on again.

7.4 Typical Application

7.4.1 Application circuit

The RJR710 series is a 150mA, low-dropout linear regulator with ultralow quiescent current. Figure 3 shows a typical application circuit for the RJR710 series.

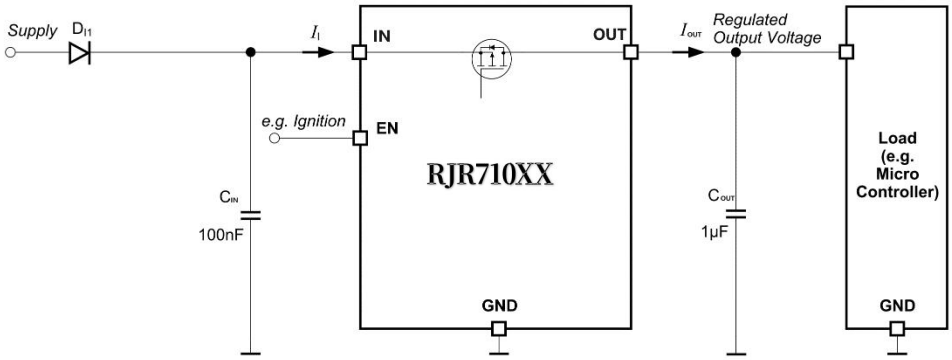


Figure 4 typical application circuit of RJR710 series

7.4.2 Input Capacitor

Although an input capacitor is not required for stability, good analog design practice is to connect a 0.1μF to 22μF capacitor from IN to GND. This capacitor counteracts reactive input sources and improves transient response, input ripple rejection, and PSRR. The voltage rating must be greater than the maximum input voltage.

7.4.3 Output Capacitor

To ensure the stability of the RJR710 series, the device requires an output capacitor with a value in the range from 1 μF to 200 μF and with an ESR range between 0.001 Ω and 5 Ω. It is recommended to select a ceramic capacitor with low ESR to improve the load transient response.

7.4.4 Power Dissipation

power dissipation in the regulator depends on the input-to-output voltage difference and load conditions. PD can be approximated using Equation 1:

$$P_D = (V_{IN} – V_{OUT}) \times I_{OUT}$$

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8 Layout

8.1 Layout Guidelines

Layout is an important step for LDO power supplies, especially for high-voltage and large-output-current supplies. If the layout is not carefully designed, the regulator can fail to deliver enough output current because of thermal limitations. To improve the thermal performance of the device, and to maximize the current output at high ambient temperature, spread the copper under the thermal pad as far as possible and put enough thermal vias on the copper under the thermal pad. Figure 4 shows an example layout.

8.2 Layout Example

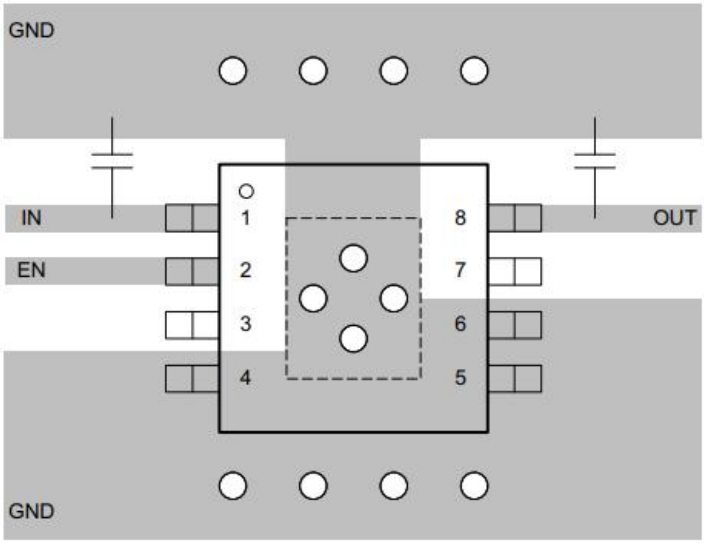
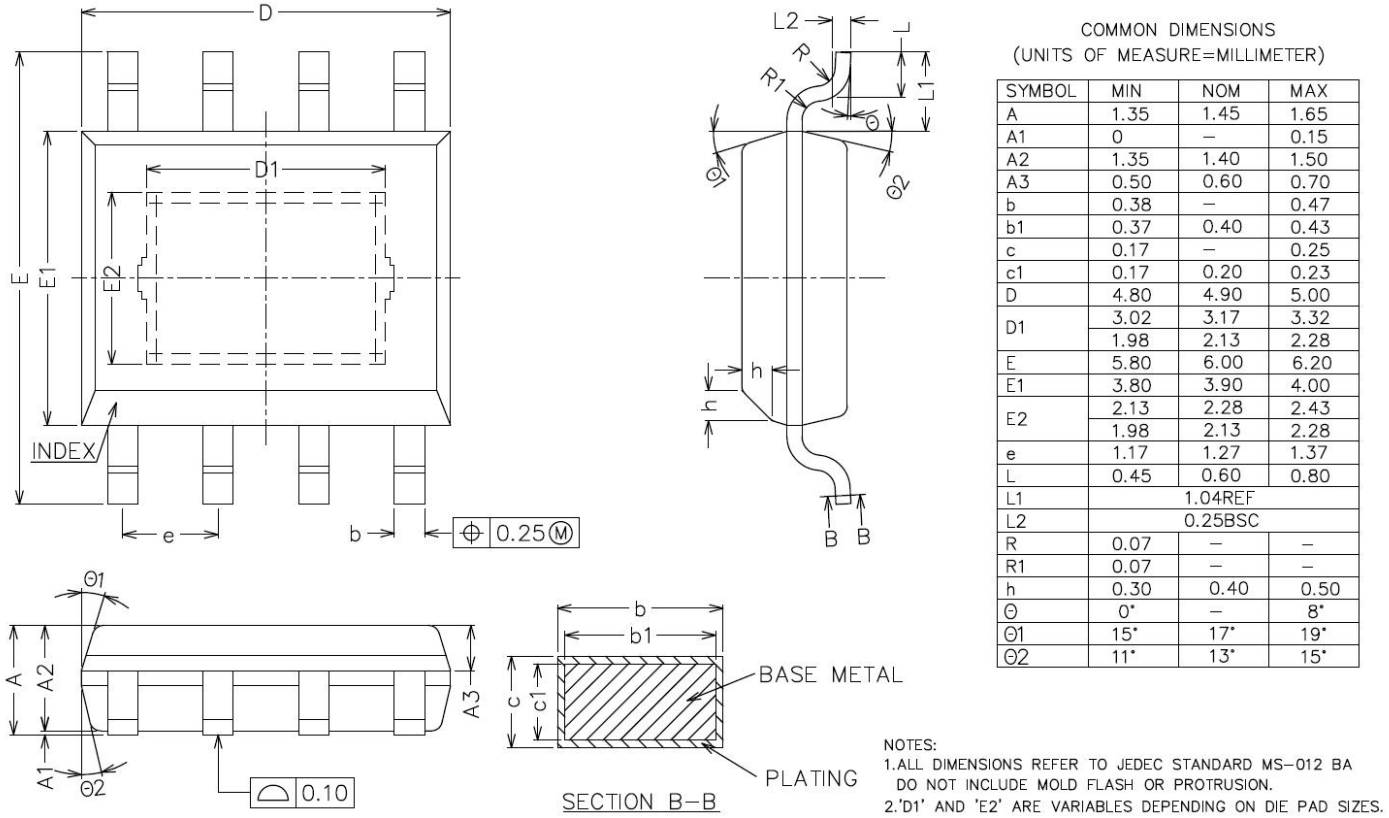


Figure 5 RJR710 series example layout diagram

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9 Package Information

9.1 SOP8-EP



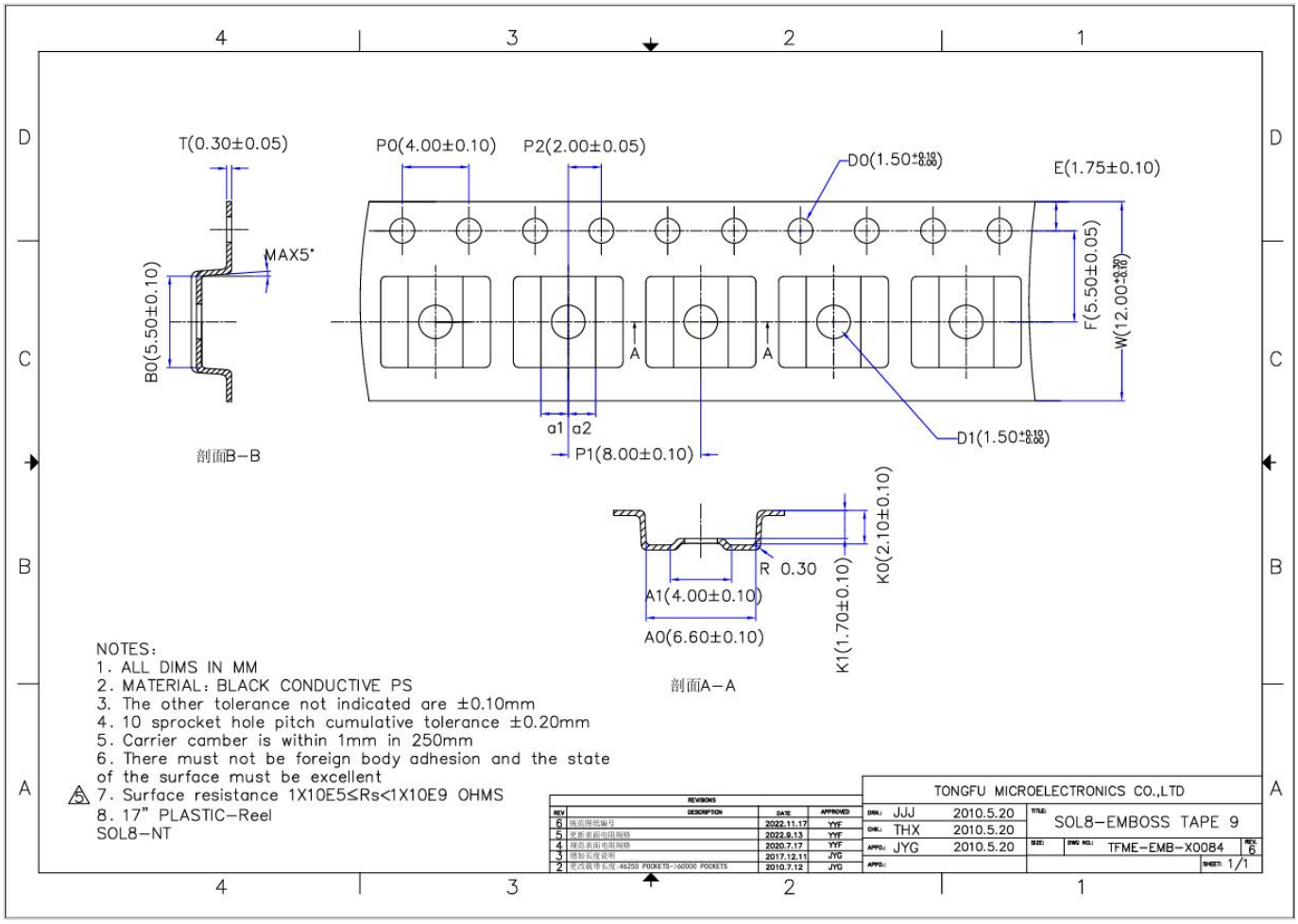
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.45	1.65
A1	0	–	0.15
A2	1.35	1.40	1.50
A3	0.50	0.60	0.70
b	0.38	–	0.47
b1	0.37	0.40	0.43
c	0.17	–	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
D1	3.02	3.17	3.32
	1.98	2.13	2.28
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.13	2.28	2.43
	1.98	2.13	2.28
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	–	–
R1	0.07	–	–
h	0.30	0.40	0.50
Θ	0°	–	8°
Θ1	15°	17°	19°
Θ2	11°	13°	15°

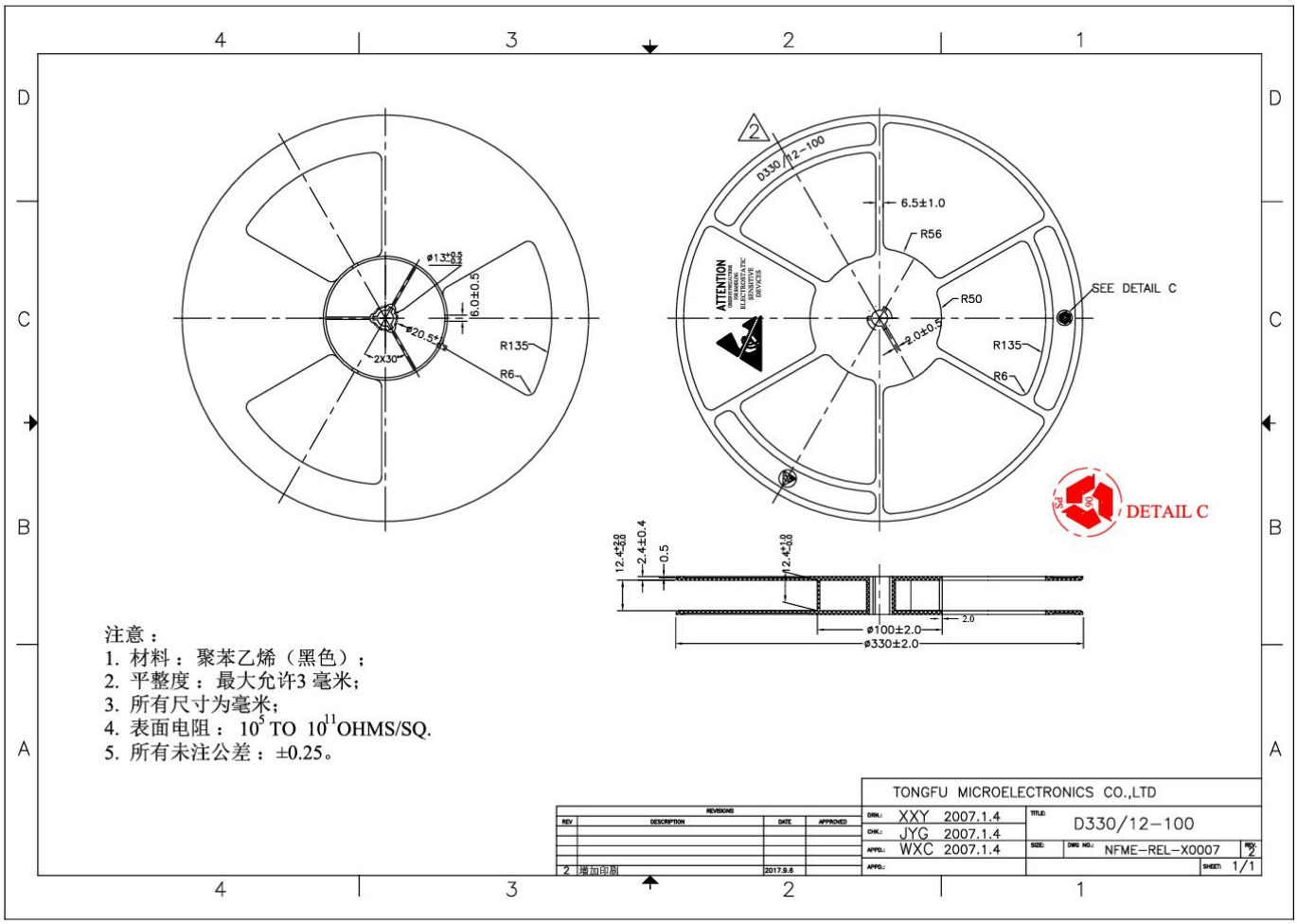
NOTES:
1. ALL DIMENSIONS REFER TO JEDEC STANDARD MS-012 BA
   DO NOT INCLUDE MOLD FLASH OR PROTRUSION.
2. 'D1' AND 'E2' ARE VARIABLES DEPENDING ON DIE PAD SIZES.

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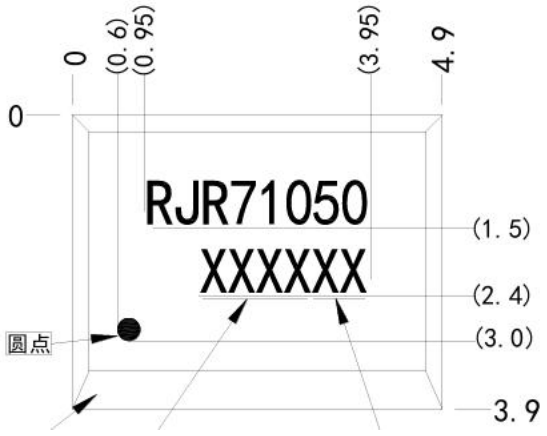
9.2 SOP8-L


T(0.30±0.05)
P0(4.00±0.10)
P2(2.00±0.05)
D0(1.50+0.10 0.00)
E(1.75±0.10)
MAX5°
B0(5.50±0.10)
F(5.50±0.05)
W(12.00+0.30 -0.10)
A
A
a1
a2
P1(8.00±0.10)
D1(1.50+0.10 0.00)
剖面B-B
R 0.30
K0(2.10±0.10)
A1(4.00±0.10)
A0(6.60±0.10)
K1(1.70±0.10)
剖面A-A
NOTES:
1. ALL DIMS IN MM
2. MATERIAL: BLACK CONDUCTIVE PS
3. The other tolerance not indicated are ±0.10mm
4. 10 sprocket hole pitch cumulative tolerance ±0.20mm
5. Carrier camber is within 1mm in 250mm
6. There must not be foreign body adhesion and the state of the surface must be excellent
7. Surface resistance 1X10E5≤Rs<1X10E9 OHMS
8. 17" PLASTIC-Reel
SOL8-NT
REVISIONS
REV DESCRIPTION DATE APPROVED
6 2022.11.17 YYF
5 2022.9.13 YYF
4 2020.7.17 YYF
3 2017.12.11 JYG
2 2010.7.12 JYG
TONGFU MICROELECTRONICS CO.,LTD
DRN: JJJ 2010.5.20
CHK: THX 2010.5.20
APPD: JYG 2010.5.20
TITLE: SOL8-EMBOSS TAPE 9
SIZE: DWG NO: TFME-EMB-X0084 REV: 6
SHEET: 1/1

9.3 Split Reel Information



10 PrintForm Information



Line1: Part Number，fixed
Line2: Digit Date Code&2 bit flow code

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11 Order Information

Orderable Device	MSL	Package Type	Package Qty
RJR71050-QHSPR	3	SOP8-EP	2500
RJR71033-QHSPR	3	SOP8-EP	2500
RJR71050-QDNR	3	DFN8-3x3	4000
RJR71033-QDNR	3	DFN8-3x3	4000
RJR71050-QSTBR	3	SOT223-4	2500
RJR71033-QSTBR	3	SOT223-4	2500

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12 Revision history

Revision	Description	Date
0.1	Initial version	2025/06
0.2	Update key feature description	2025/7

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