

ETQ61H41ADJY1 - High Input Very-Low I_Q 150mA LDO

General Description

The ETQ61H41ADJY1 is a low dropout with 150mA load ability with enable function LDO. It operates from 3V ~ 40V. The quiescent current is 5.5uA with no load. The devices feature integrated short-circuit and over-current protection. They are quite suitable for standby microprocessor control-unit systems, especially in automotive applications.

ETQ61H41ADJY1 is available in the DFN8(3×3) package.

Features

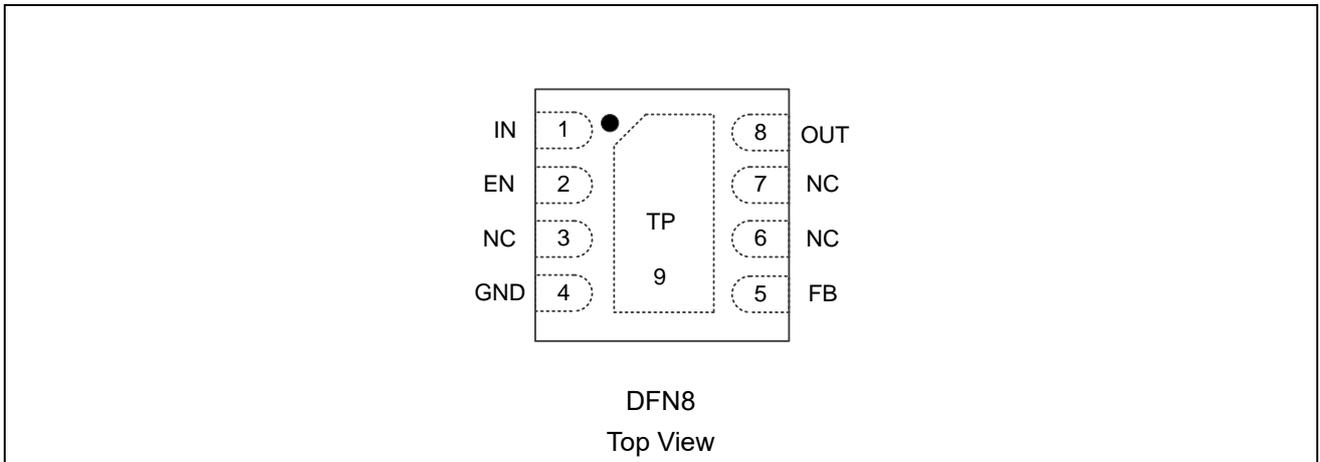
- Input Voltage Range from 3V to 40V
- 150mA Load Current
- I_Q is 5.5μA Typical
- ADJ Output Voltage Range 1.8~15V
- Low Dropout is 220mV at 150mA Load@V_{OUT}=5V
- Over-Temperature Protection
- Current-Limit Protection
- Automotive AEC-Q100 Grade 1 Qualified

Mark Specification Label

Part No.	Package	MSL
ETQ61H41ADJY1	DFN8 (3×3)	1

ETQ61H41ADJY1

Pin Configuration

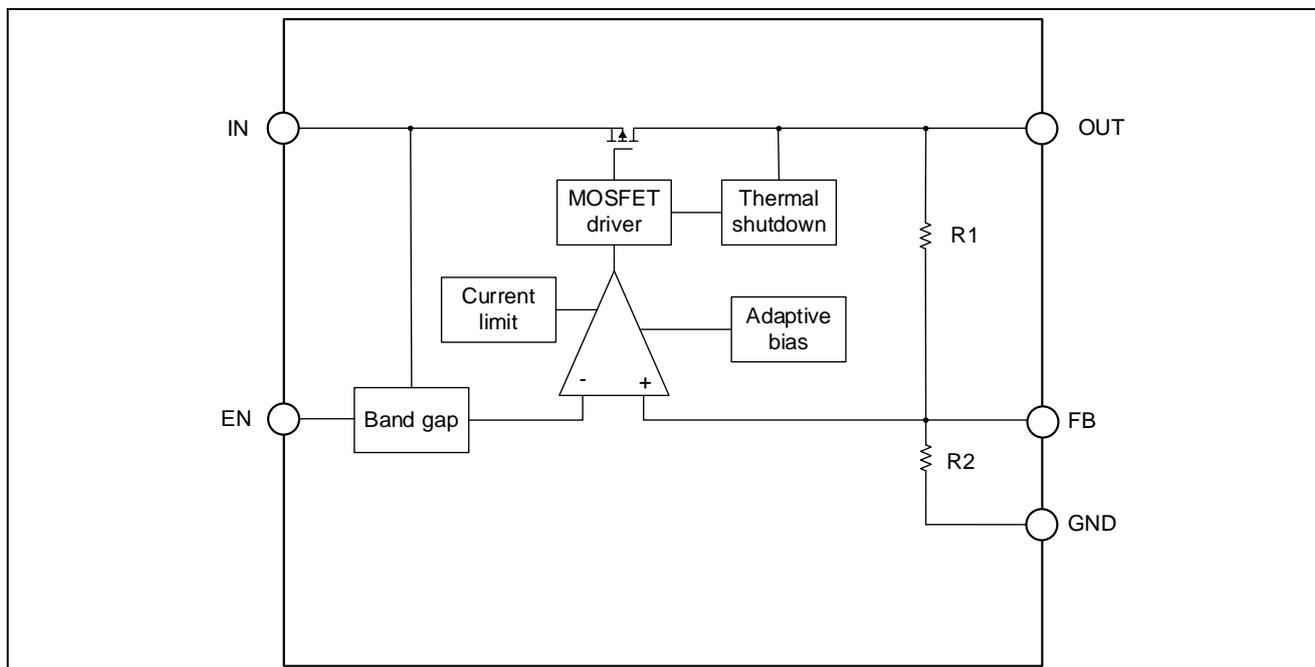


Pin Function

Pin No.	Pin Name	Pin Function
1	IN	Input Pin
2	EN	Enable Input Pin
3,6,7	NC	No Connect
4	GND	Ground Pin
5	FB	FB Voltage
8	OUT	Output Pin
9	TP	Thermal Pad

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Block Diagram



Functional Description

Input Capacitor

A 1 μ F~10 μ F ceramic capacitor is recommended to connect between V_{IN} and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both V_{IN} and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1 μ F to 10 μ F, Equivalent Series Resistance (ESR) is from 5m Ω to 100m Ω , and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

Dropout Voltage

The ETQ61H41ADJY1 uses a PMOS pass transistor to achieve low dropout. When $(V_{IN} - V_{OUT})$ is less than the dropout voltage (V_{DROPO}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DO} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as $(V_{IN} - V_{OUT})$ approaches dropout operation.

Feedback Voltage

One can select an output voltage between 1.8V to 15V by using an external resistor divider. Calculate the output voltage using the following equation, where $V_{FB} = 1.215$ V, $R2 \geq 1$ M Ω .

$$V_{OUT} = V_{FB} \times (1 + R1/R2)$$

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Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 135°C, the output circuitry is again enabled.

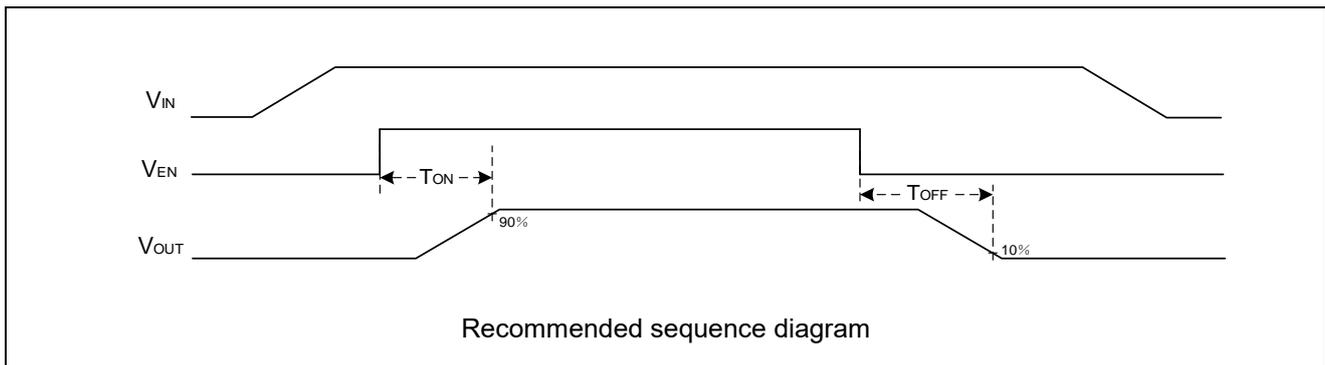
Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the ($V_{IN} - V_{OUT}$) voltage and the load current.

Current-Limit Protection

The ETQ61H41ADJY1 provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

ON/OFF Input Operation

The ETQ61H41ADJY1 is turned on by setting the EN pin higher than V_{IH} threshold, and is turned off by pulling it lower than V_{IL} threshold. IN port needs to be powered on before the EN port. The recommended sequence diagram:



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Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V _{IN}	Input Voltage ⁽¹⁾	0~45 & V _{IN} >V _{EN}	V
V _{EN}	EN Voltage	0~12	V
V _{OUT}	Output Voltage	0~18	V
V _{FB}	FB Voltage	0~6	V
T _{J(MAX)} ⁽²⁾	Maximum Junction Temperature	150	°C
T _{STG}	Storage Temperature	-65~150	°C
ESD ⁽³⁾	HBM Capability	±2000	V
	CDM Capability	±1500	V
Lu	Latch up Current Maximum Rating ⁽³⁾	±200	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1. Refer to Electrical Characteristics and Application Information for Safe Operating Area and IN port needs to be powered on before the EN port.

Note2. When T_J > 125°C, there will be a large deviation in voltage accuracy.

Note3. This device series incorporates ESD protection and is tested by the following methods:

HBM tested per AEC-Q100-002

CDM tested per AEC-Q100-011

Latch up Current Maximum Rating tested per AEC-Q100-004.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
R _{θJA}	DFN8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	50	°C/W
P _D	DFN8	Max Power Dissipation @25°C	2.0	W

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V _{IN}	Input Voltage	3 to 40	V
V _{EN}	EN Voltage	3 to 10	V
I _{OUT}	Output Current	0 to 150	mA
T _A	Operating Ambient Temperature	-40 to 125	°C
C _{IN}	Input Capacitor Value	1 to 10	uF
C _{OUT}	Output Capacitor Value	1 to 10	uF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

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Electrical Characteristics

($V_{IN} = V_{OUT} + 2V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, $T_A = -40^{\circ}C \sim 125^{\circ}C$ unless otherwise noted. Typical values are at $T_A = +25^{\circ}C$.)⁽⁴⁾

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Input Voltage ⁽⁵⁾		3.0		40	V
V_{OUT}	Output Voltage	$T_A = +25^{\circ}C$	-2.0%		+2.0%	V
		$-40^{\circ}C \leq T_A \leq 125^{\circ}C$	-3.5%		+3.5%	
I_Q	Quiescent Current ⁽⁶⁾	$I_{OUT} = 0mA$		5.5	10	μA
I_{Q_OFF}	Standby Current	$V_{EN} = 0V$, $T_A = 25^{\circ}C$		0.1	1	μA
V_{FB}	Feedback Voltage	$T_A = +25^{\circ}C$	1.191	1.215	1.239	V
V_{DROP}	Dropout Voltage ⁽⁷⁾	$I_{OUT} = 150mA$, $V_{OUT} = 5V$ $T_A = +25^{\circ}C$		220	350	mV
Line _{REG}	Line Regulation	$V_{OUT} + 2V \leq V_{IN} \leq 40V$ $I_{OUT} = 10mA$		0.01	0.05	%/V
Load _{REG}	Load Regulation	$1mA \leq I_{OUT} \leq 150mA$, $V_{OUT} = 5V$ $V_{IN} = V_{OUT} + 2V$		10	30	mV
ILMT	Current Limit	$V_{IN} = V_{OUT} + 2V$	200	350	500	mA
PSRR	Power Supply Rejection Ratio ⁽⁸⁾	$f = 1 kHz$, $V_{IN} = V_{OUT} + 2V$, $V_{OUT} = 5V$, $I_{OUT} = 20mA$		70		dB
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage "H"	1.4			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage "L"			0.4	V
e_{EN}	Output Noise Voltage ⁽⁸⁾	$V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 1mA$, $f = 10Hz$ to $100kHz$, $C_{OUT} = 1\mu F$		45* V_{OUT}		μV_{rms}
T_{SD}	Thermal Shutdown Temperature ⁽⁸⁾	Temperature Increasing from $T_A = +25^{\circ}C$	135	155		$^{\circ}C$
T_{SDH}	Thermal Shutdown Hysteresis ⁽⁸⁾	Temperature Falling from T_{SD}		20		$^{\circ}C$

Note4. Here V_{IN} means internal circuit can work normal. If $V_{IN} < V_{OUT}$, Output voltage follow V_{IN} ($I_{OUT} = 1mA$), circuit is safety.

Note5. The minimum operating voltage is 3.0V. $V_{DROP} = V_{IN(min)} - V_{OUT}$.

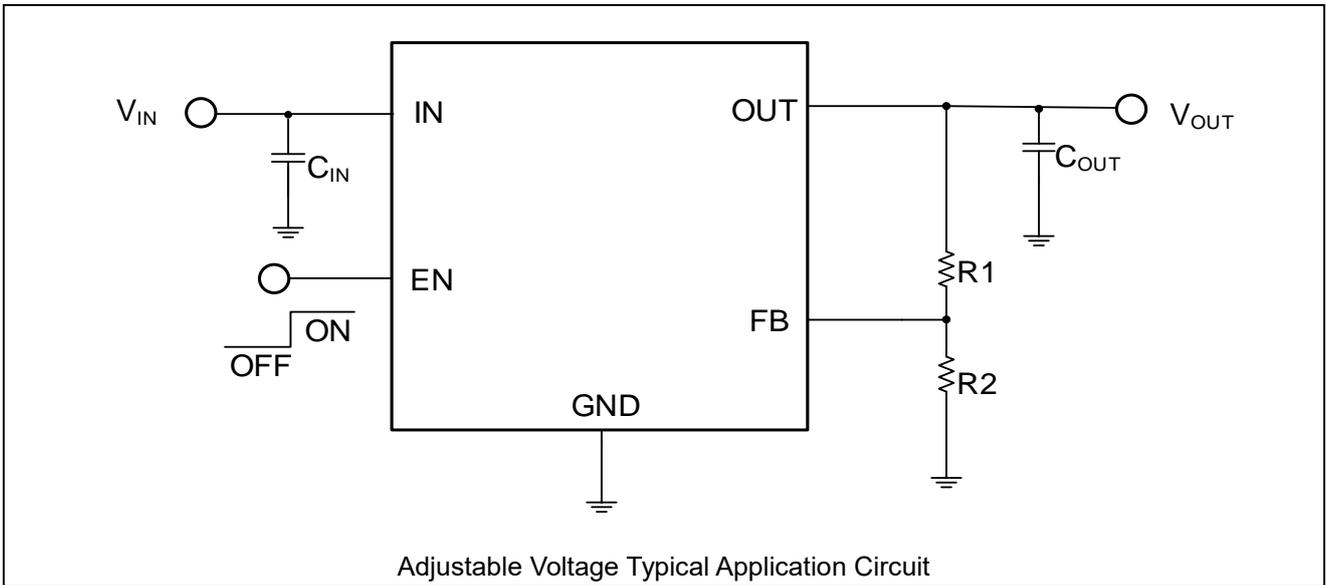
Note6. R2 needs to be greater than or equal to $1M\Omega$.

Note7. V_{DROP} FT test method: test the V_{OUT} voltage at $V_{SET} + V_{DROPMAX}$ with 150mA output current.

Note8. Guaranteed by design and characterization. not a FT item.

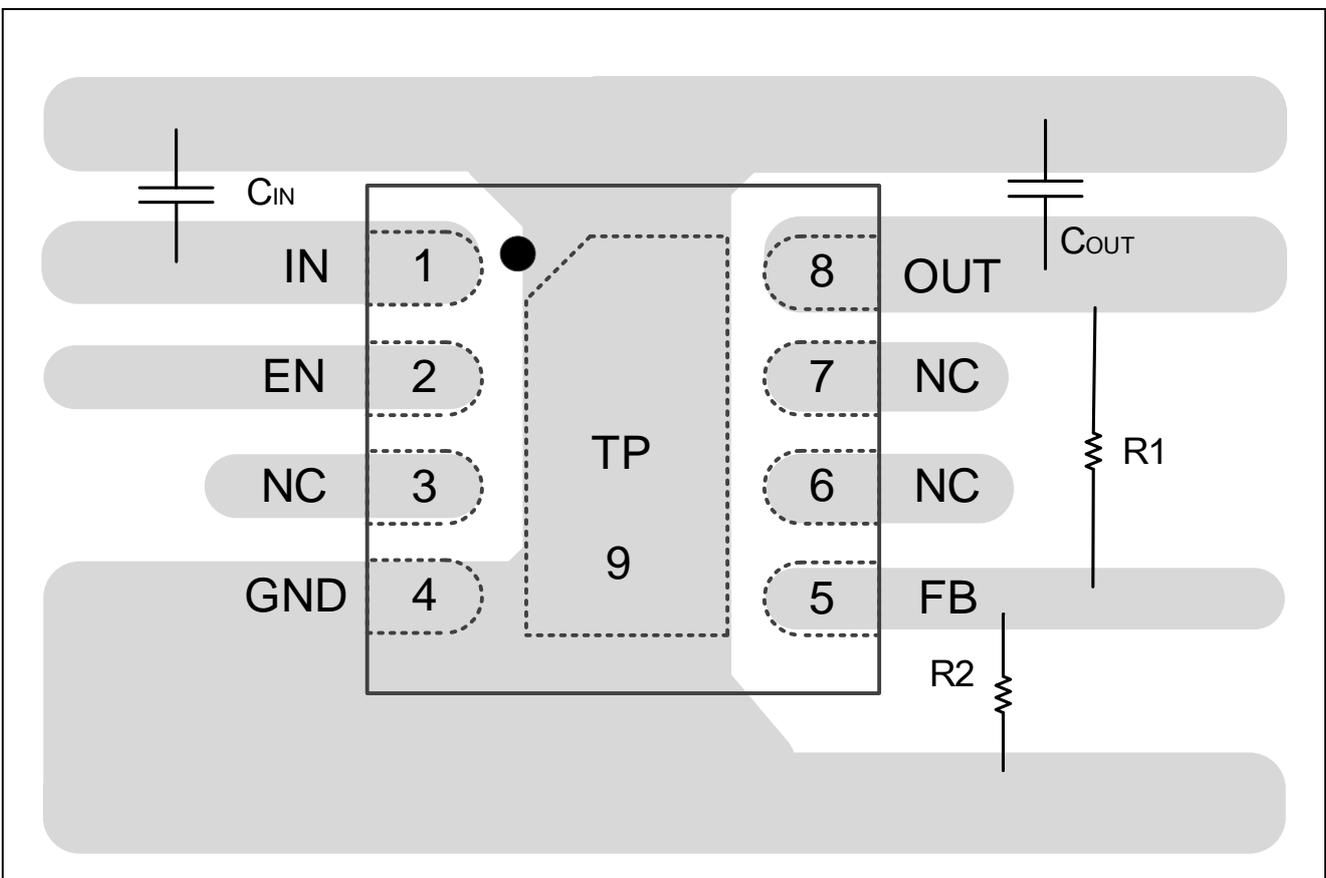
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Application Circuits



Note9. $V_{OUT} = 1.2 \times (1 + R_1/R_2)$, $R_2 \geq 1M\Omega$.

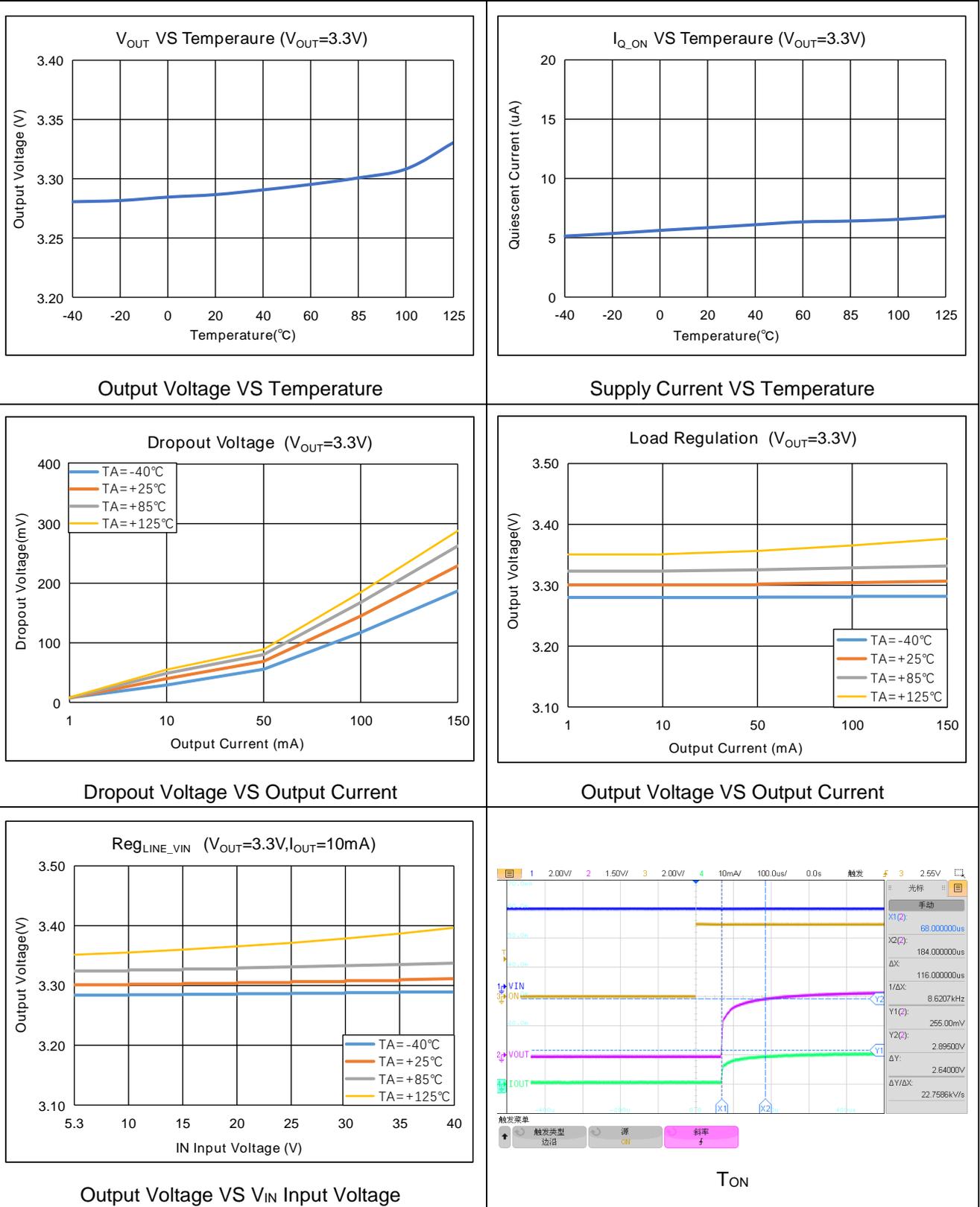
PCB Layout Guide



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Typical Characteristics

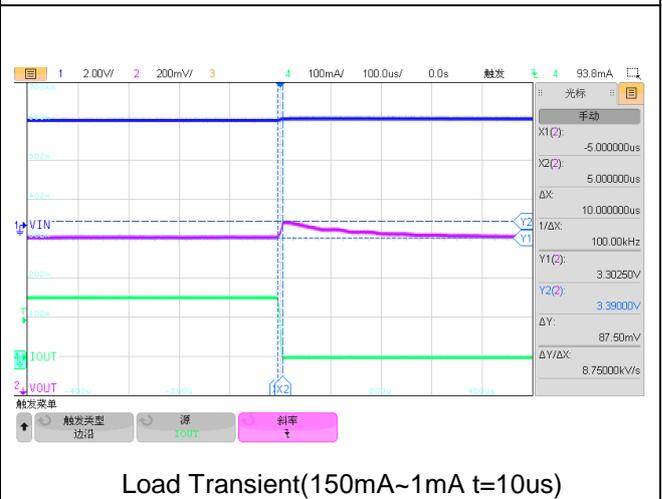
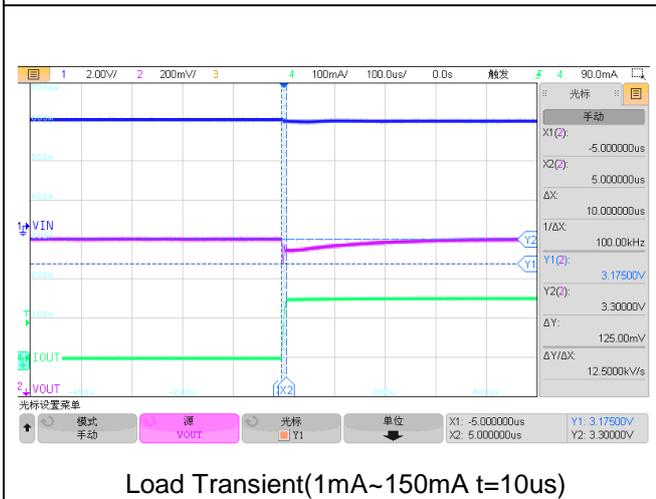
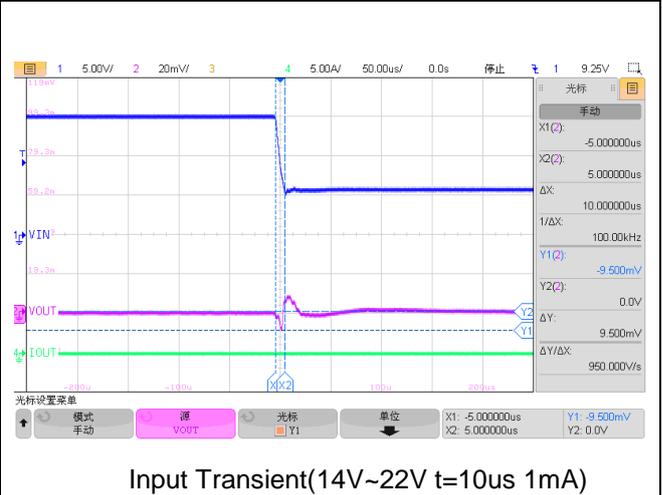
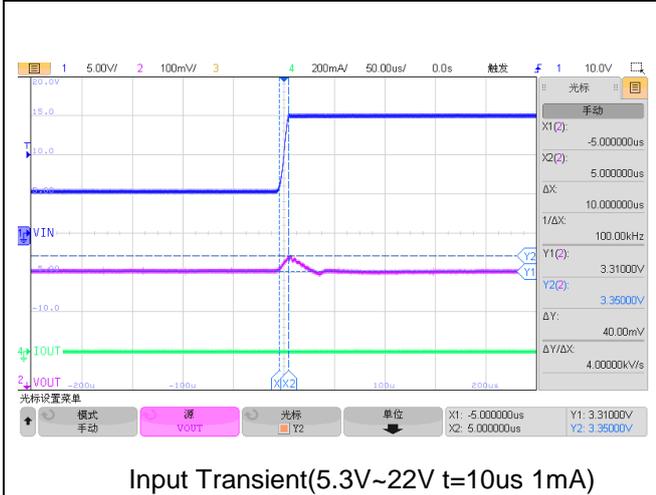
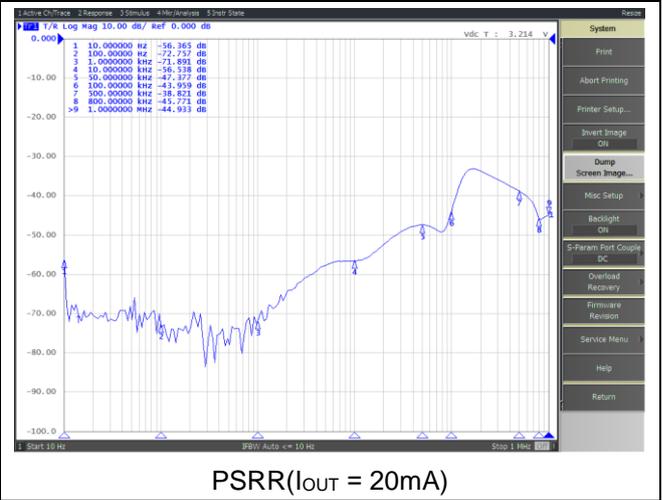
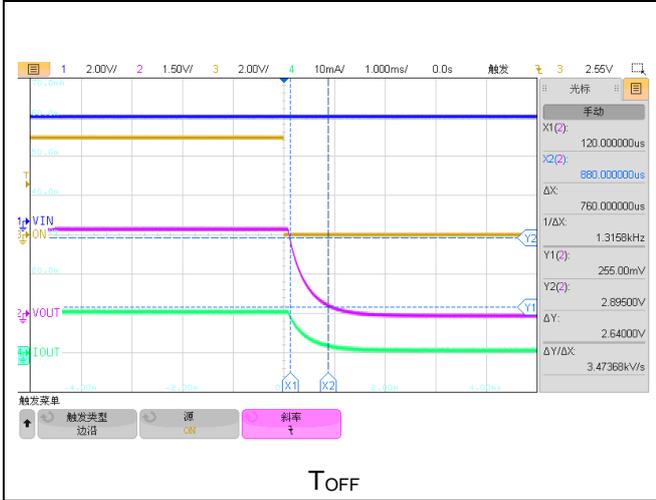
($V_{OUT}=3.3V$, $V_{IN} = 5.3V$, $I_{OUT} = 10mA$, $C_{IN} = \text{Ceramic } 1.0\mu F$, $C_{OUT} = \text{Ceramic } 1.0\mu F$, $T_A = 25^\circ C$)



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Typical Characteristics(Continued)

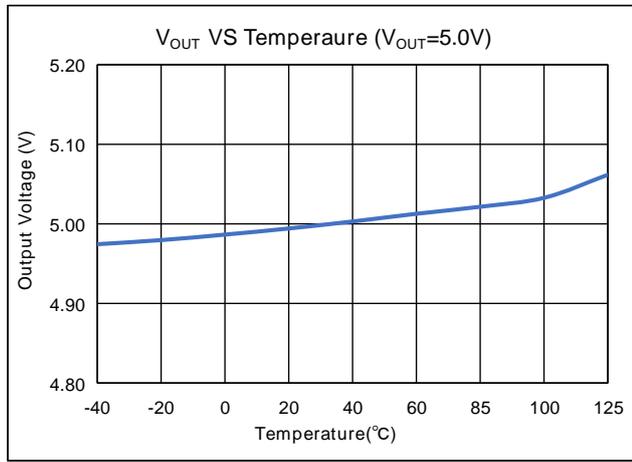
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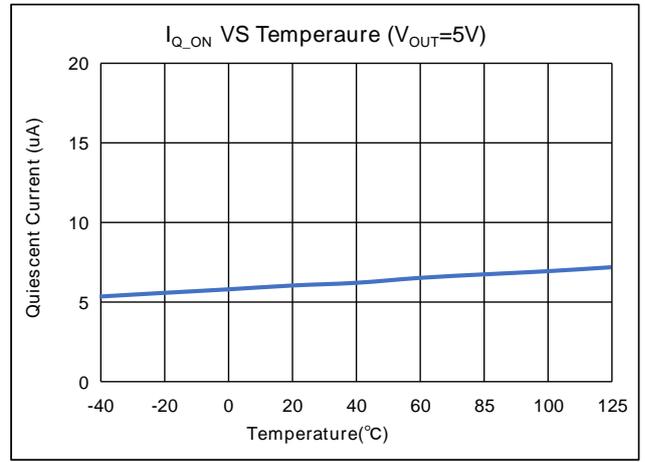
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Typical Characteristics(Continued)

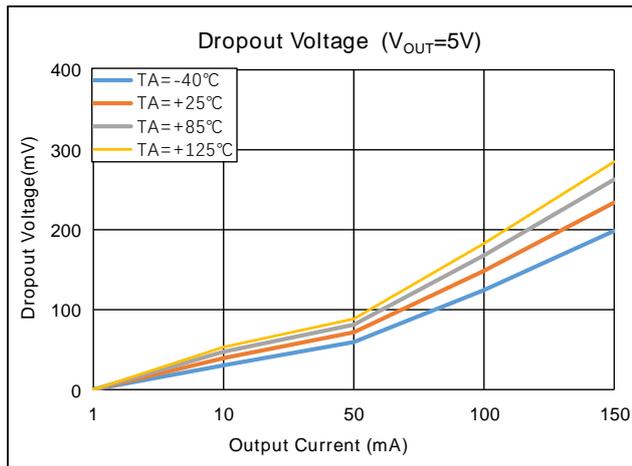
($V_{OUT}=5V$, $V_{IN}=7V$, $I_{OUT}=10mA$, $C_{IN}=\text{Ceramic } 1.0\mu F$, $C_{OUT}=\text{Ceramic } 1.0\mu F$, $T_A=25^\circ C$)



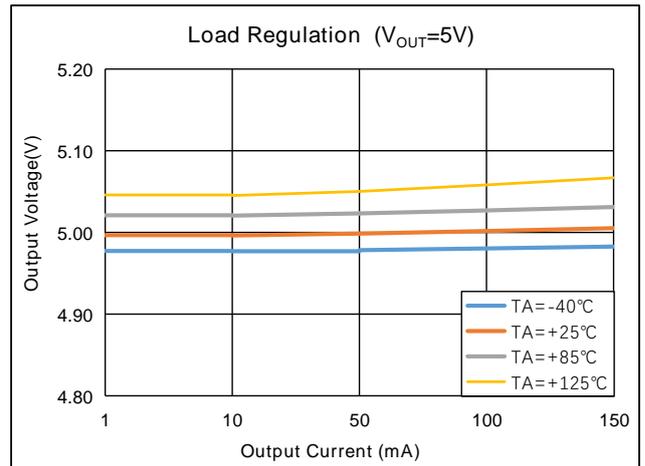
Output Voltage VS Temperature



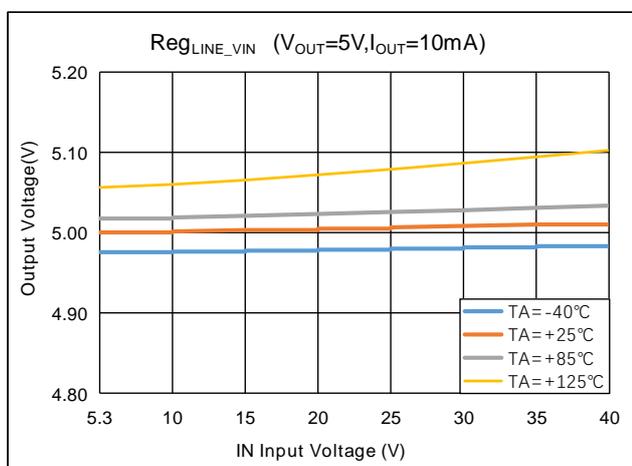
Supply Current VS Temperature



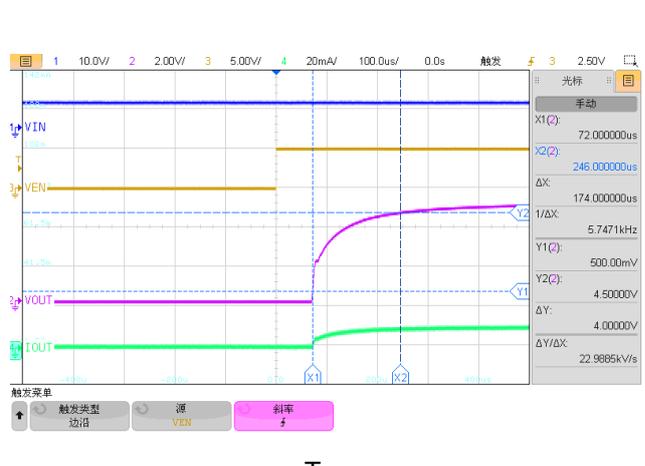
Dropout Voltage VS Output Current



Output Voltage VS Output Current



Output Voltage VS V_{IN} Input Voltage

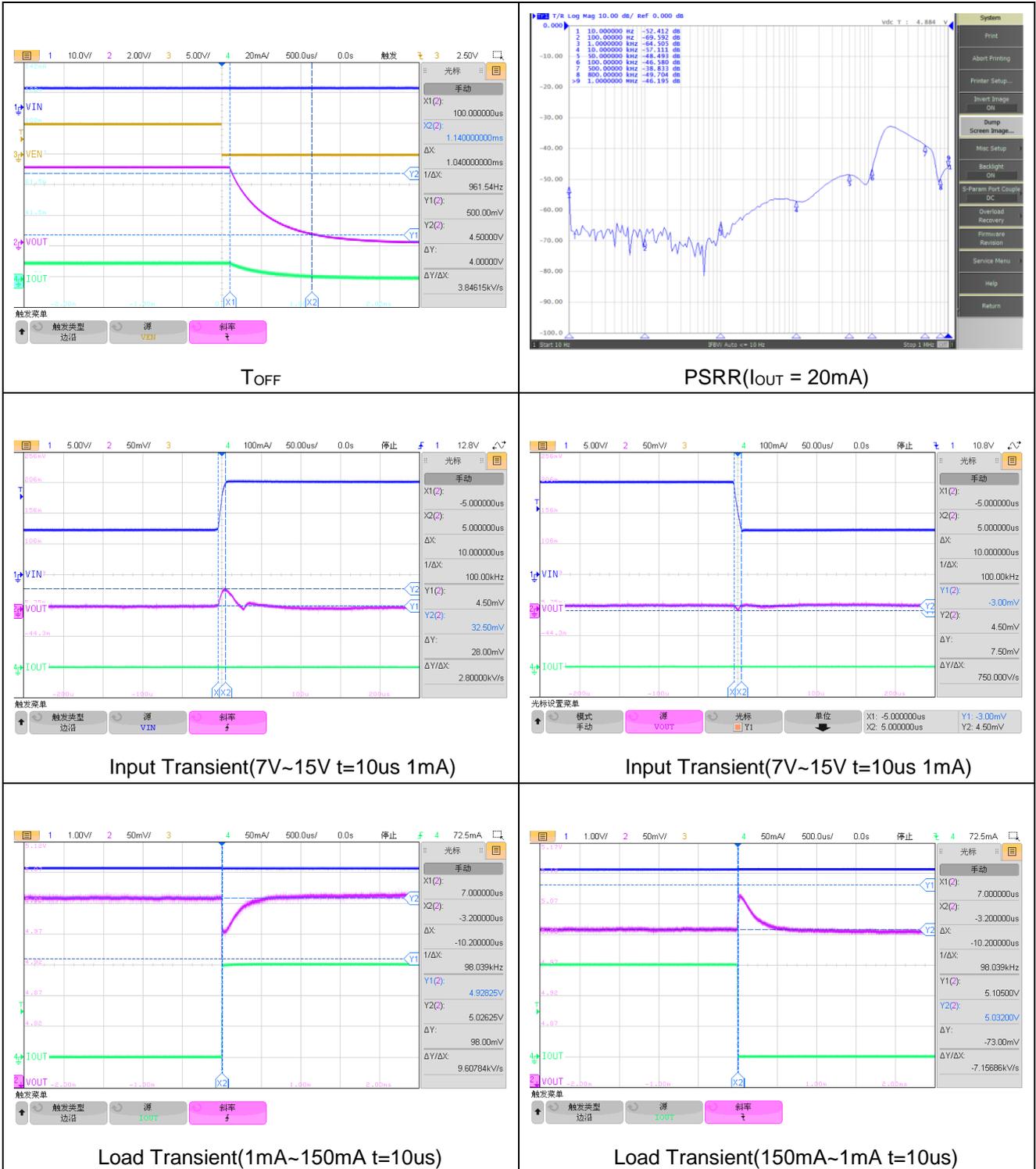


T_{ON}

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Typical Characteristics(Continued)

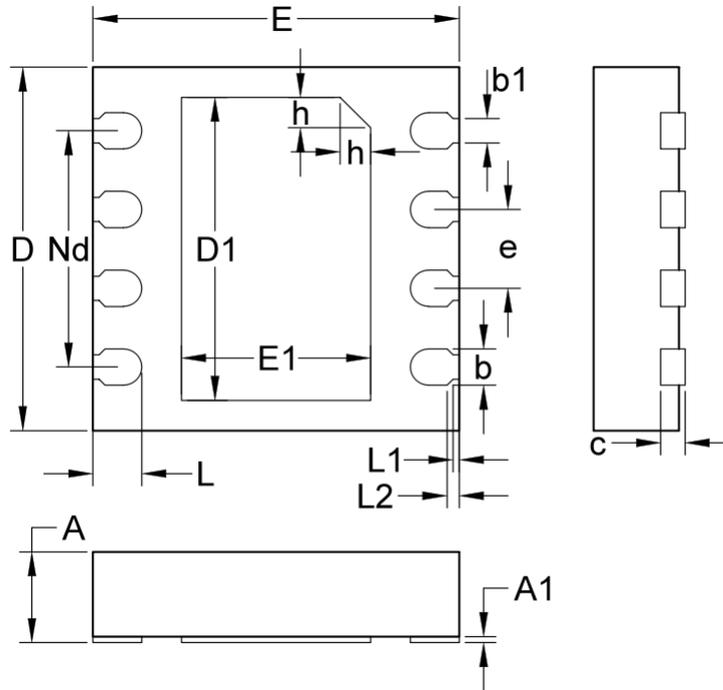
($V_{OUT}=5V$, $V_{IN}=7V$, $I_{OUT}=10mA$, C_{IN} = Ceramic $1.0\mu F$, C_{OUT} = Ceramic $1.0\mu F$, $T_A=25^\circ C$)



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Package Dimension

DFN8(3×3)

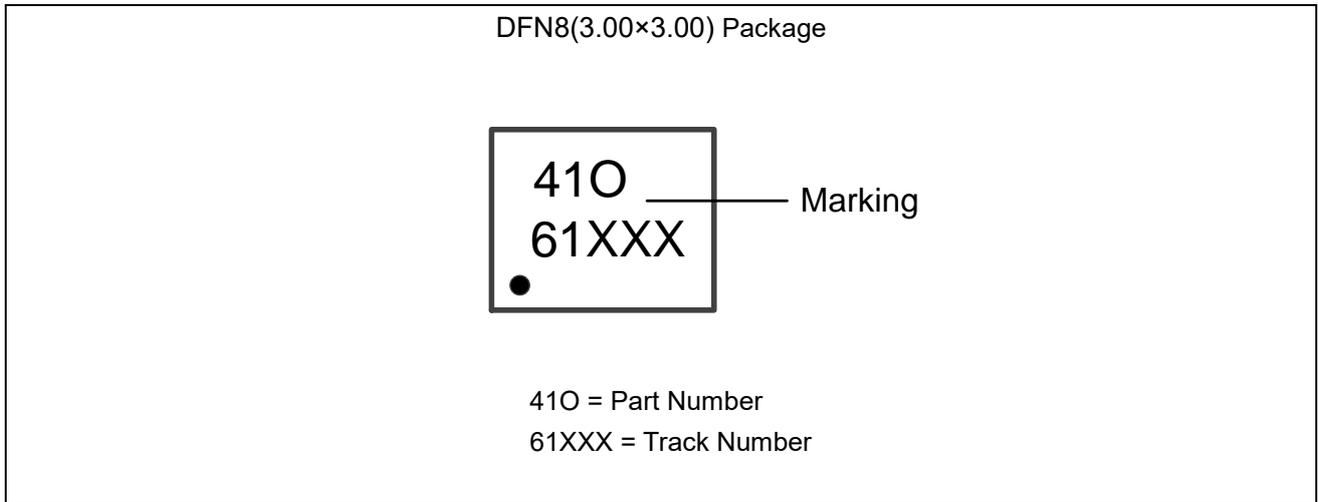


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	-	0.95
A1	0.00	0.02	0.05
b	0.25	0.30	0.35
b1	0.20REF		
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D1	2.40	2.50	2.60
e	0.65BSC		
Nd	1.95BSC		
E	2.90	3.00	3.10
E1	1.45	1.55	1.65
L	0.30	0.40	0.50
L1	0.05REF		
L2	0.10REF		
h	0.20	0.25	0.30

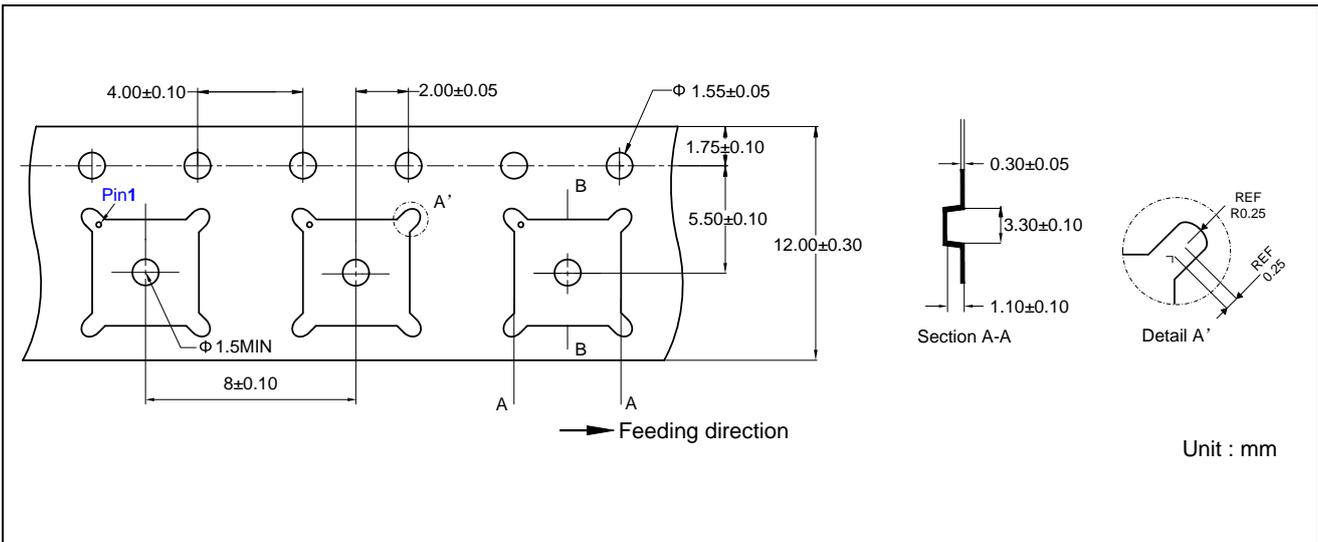
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Marking



Tape Information

DFN8(3.00×3.00) Package



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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023-09-15	Preliminary Version	Tugz	Guj,Liuxm	Liujiy
0.1	2024-11-15	Update AMR	Wangar	Guj,Liuxm	Liujiy
1.0	2024-11-20	Add Characteristic curve	Wangar	Guj,Liuxm	Liujiy
1.1	2024-11-28	Update EC table and Package Dimension	Wangar	Guj,Liuxm	Liujiy
1.2	2024-12-3	Update Marking and Tape	Wangar	Guj,Liuxm	Liujiy
1.3	2025-06-04	Update EC table	Wangar	Yangxx	Liujiy
1.4	2025-08-08	Update AMR and EC table	Wangar	Yangxx	Liujiy