

ETQ6H333Y - High Input Low IQ 200mA LDO

General Description

ETQ6H333Y is the 3.3V output high input very low I_Q 200mA LDO with enable function, it have multiple protections and good heat dissipation effect.

ETQ6H333Y is offered DFN8 package and operates over an ambient temperature range of -40°C to +125°C

Features

- Wide Input Voltage Range from 2.8V to 45V
- Fixed Output Voltage 3.3V
- Up to 200mA Load Current
- Very Low I_Q is 3.0μA typical
- Low Dropout is 680mV at 200mA Load @V_{OUT}=3.3V
- Excellent Load/Line Transient Response
- High Ripple Rejection: 64dB at 1KHz
- With OCP SCP and OTP protection
- Good Heat Dissipation Performance
- Automotive AEC-Q100 Grade 1 Qualified
 - Ambient temperature range of -40°C to +125°C
 - ESD HBM 4KV PASS
 - ESD CDM 1.5KV PASS
- Packages is DFN8 (3mm×3mm)

Device information

ETQ 6H3 33 Y

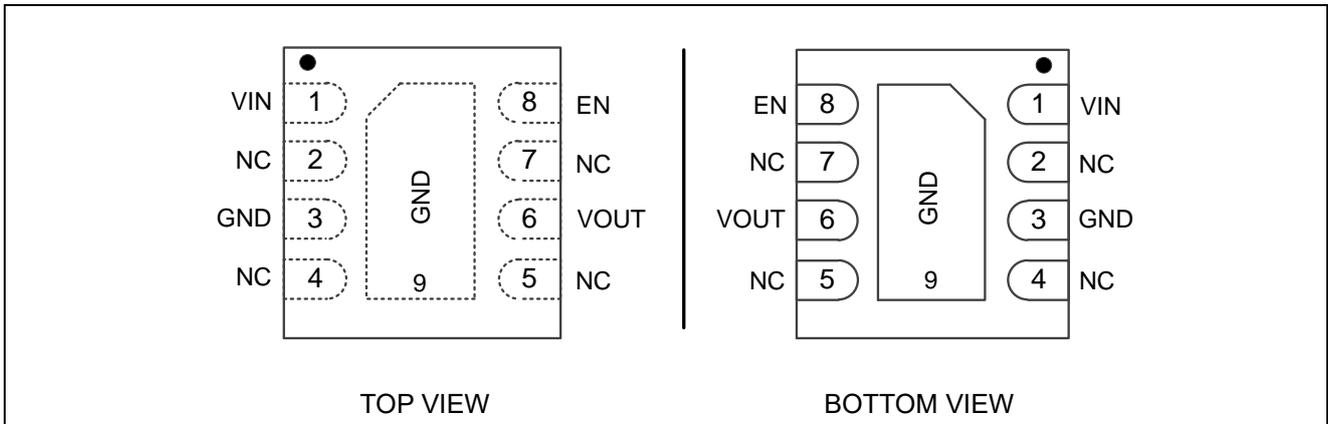
<u>33</u> Output Voltage		<u>Y</u> Package		MSL Level
33	3.3V Output Voltage	Y	DFN8 (3mm×3mm)	1

Applications

- Automotive Constant-Voltage Power Supply
- Automotive Infotainment and Cluster

ETQ6H333Y

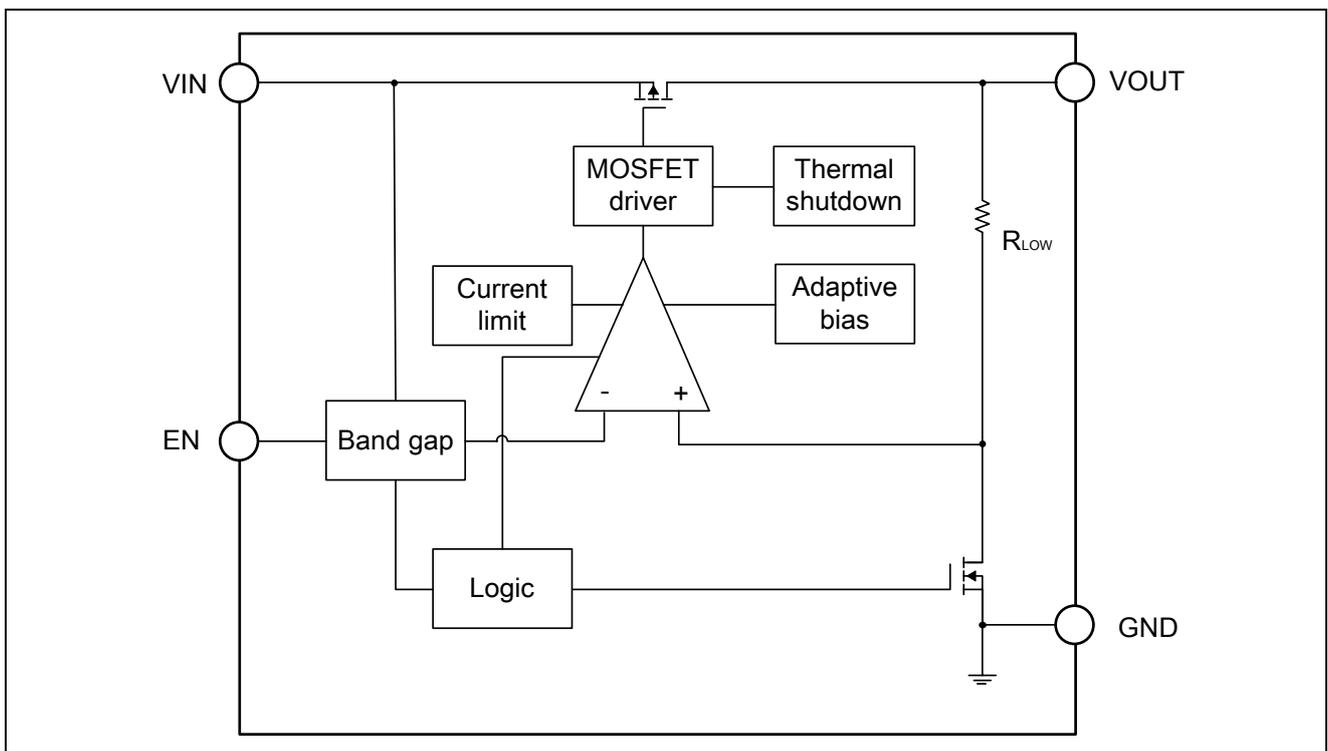
Pin Configuration



Pin Function

Pin No.	Pin Name	Pin Function
1	VIN	Supply input pin. Must be closely decoupled to GND with a 1 μ F or greater ceramic capacitor.
8	EN	Enable control input, active high. Do not leave EN floating.
6	VOUT	Output pin. Bypass a 1 μ F ceramic capacitor from this pin to ground.
2,4,5,7	NC	No connect.
3,9	GND (Thermal Pad)	Ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum thermal dissipation.

Block Diagram



ETQ6H333Y

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 V_{OUT} and GND pins.

Enable

The ETQ6H333Y delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

Dropout Voltage

The ETQ6H333Y uses a PMOS pass transistor to achieve low dropout. When ($V_{IN} - V_{OUT}$) is less than the dropout voltage (V_{DROP}), 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_{DROP} 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.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 150°C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 130°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. For reliable operation, limit junction temperature to 150°C maximum.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance.

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For recommended operating condition specifications the maximum junction temperature is 150°C and T_A is the ambient temperature. The junction to ambient thermal resistance (θ_{JA}) is layout dependent.

For DFN8(3x3) package, the thermal resistance (θ_{JA}) is 62.5°C/W on the test board. The maximum power dissipation at $T_A = 25^\circ\text{C}$ can be calculated by the following formula:

$$P_{D(\text{MAX})} = (150^\circ\text{C} - 25^\circ\text{C}) / (62.5^\circ\text{C} / \text{W}) = 2 \text{ W for DFN8(3x3) package}$$

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(\text{MAX})}$ and thermal resistance (θ_{JA}).

Current-Limit Protection

The ETQ6H333Y 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.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage	-0.3~53	V
V_{OUT}	Output Voltage	-0.3~6	V
V_{EN}	Chip Enable Input	-0.3~53	V
$T_{J(\text{MAX})}$	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65~150	°C
V_{ESD}	HBM per AEC-Q100-002(EIA/JESD22-A114)	±4000	V
	CDM per AEC-Q100-011(EIA/JESD22-C101)	±1500	V
I_{LU}	Latch up Current Maximum Rating per AEC-Q100-004(EIA/JESD78E)	±200	mA

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	DFN8(3x3)	Thermal Characteristics, Thermal Resistance, Junction-to-Air	62.5	°C/W
P_D	DFN8(3x3)	Max Power Dissipation @25°C	2.0	W

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.8 to 45	V
I_{OUT}	Output Current	0 to 200	mA
T_A	Operating Ambient Temperature	-40 to 125	°C
C_{IN}	Effective Input Ceramic Capacitor Value	1 to 10	µF
C_{OUT}	Effective Output Ceramic Capacitor Value	1 to 10	µF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

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Electrical Characteristics

($V_{IN} = 5.3V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{IN}^{(1)}$	Operating Input Voltage		2.8		45	V
V_{OUT}	Output Voltage	$T_A = +25^\circ C$	-2%		+2%	V
		$-40^\circ C \leq T_A \leq 125^\circ C$, $I_{OUT} = 1mA$	-3%		+3%	
I_{Q_ON}	Quiescent Current	$I_{OUT} = 0mA$, $-40^\circ C \leq T_A \leq 125^\circ C$		3	12	μA
I_{Q_OFF}	Standby Current	$V_{EN} = 0V$, $T_A = 25^\circ C$		0.1	1	μA
Reg_{LINE}	Line Regulation	$V_{IN} = 5.3V$ to $45V$, $I_{OUT} = 10mA$		0.05	0.20	%/V
Reg_{LOAD}	Load Regulation	$1mA \leq I_{OUT} \leq 200mA$, $V_{IN} = 5.3V$		15	30	mV
$V_{DROP}^{(2)}$	Dropout Voltage	$I_{OUT} = 200mA$		680	1200	mV
I_{LMT}	Current Limit	$V_{IN} = 5.3V$	350	650	1000	mA
I_{SHORT}	Short Current Limit	$V_{IN} = 5.3V$		130		mA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage "H"	1.2			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage "L"			0.4	V
I_{EN}	EN Pin Current	$V_{EN} = 0 \sim 45V$		1		μA
$PSRR^{(3)}$	Power Supply Rejection Ratio	$f = 1kHz$, $V_{IN} = 5.3V$ $I_{OUT} = 20mA$		64		dB
$e_N^{(3)}$	Output Noise Voltage	$V_{IN} = 5.3V$, $I_{OUT} = 1mA$, $f = 10Hz$ to $100kHz$, $C_{OUT} = 1\mu F$		150		μV_{rms}
$T_{TSD}^{(3)}$	Thermal Shutdown Threshold	Temperature Increasing from $T_A = +25^\circ C$		150		$^\circ C$
$T_{HYS}^{(3)}$	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}		20		$^\circ C$

Note1. 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.

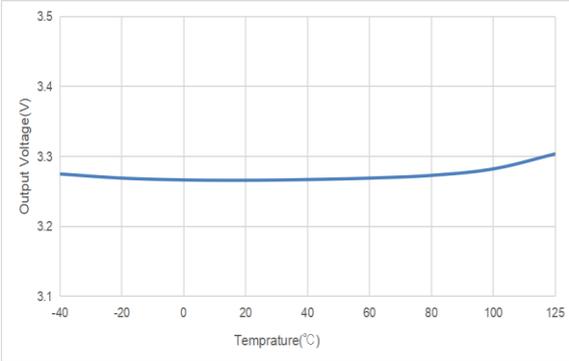
Note2. V_{DROP} FT test method: test the V_{OUT} voltage at $V_{SET} + V_{DROP_MAX}$ with 200mA output current.

Note3. Guaranteed by design and characterization. not a FT item.

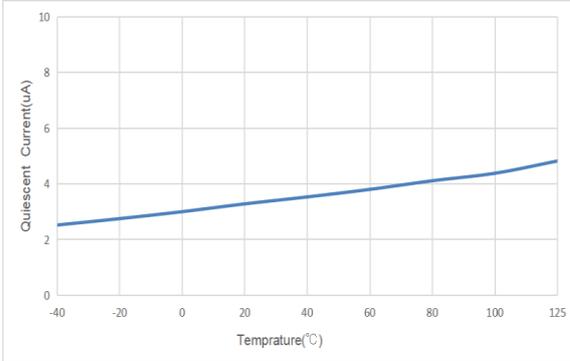
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Typical Characteristics

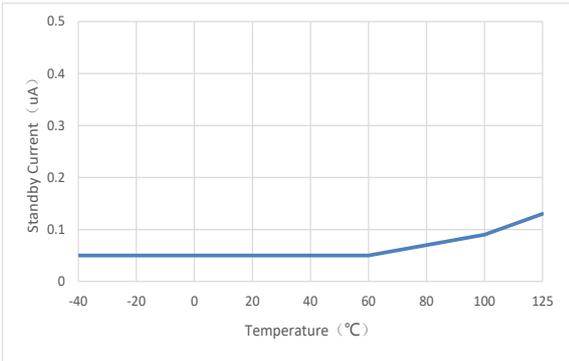
($V_{IN} = 5.3V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)



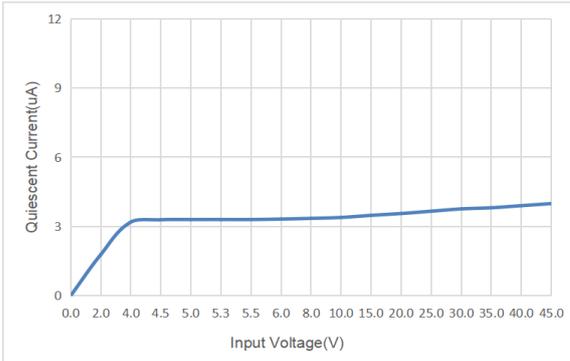
Output Voltage VS Temperature



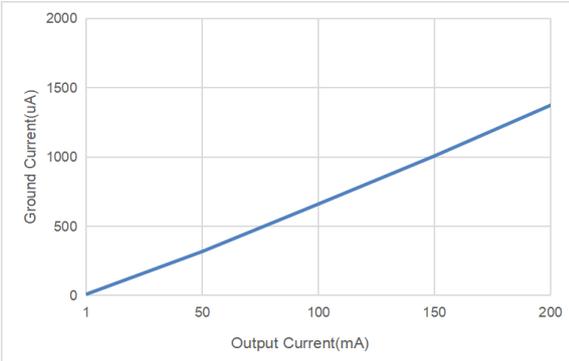
Quiescent Current VS Temperature



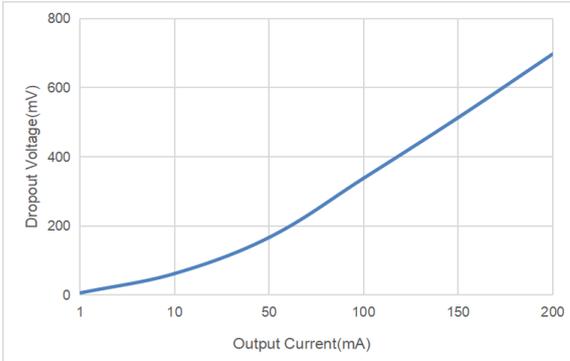
Standby Current VS Temperature



Quiescent Current VS Input Voltage



Ground Pin Current VS Output Current

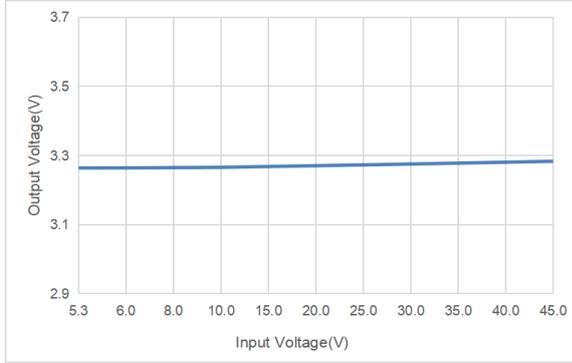


Dropout Voltage VS Output Current

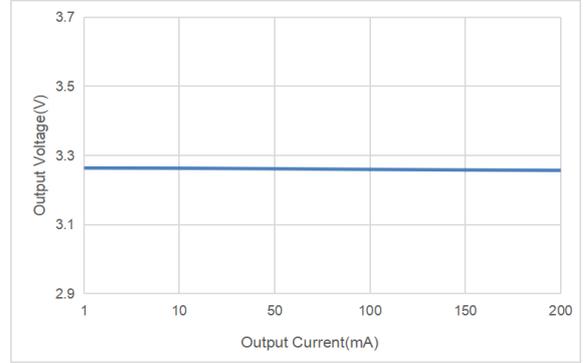
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Typical Characteristics (Continued)

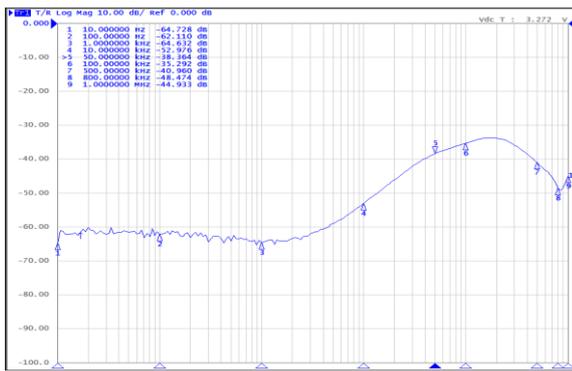
($V_{IN} = 5.3V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)



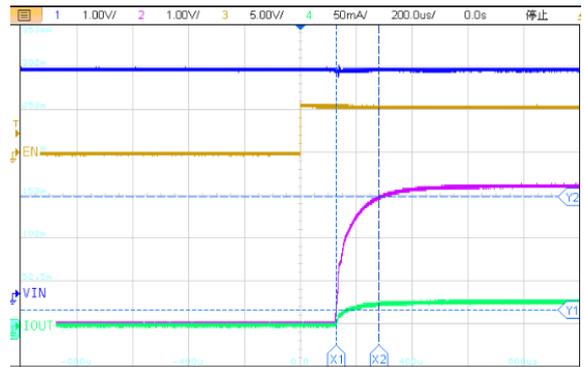
Output Voltage VS Input Voltage



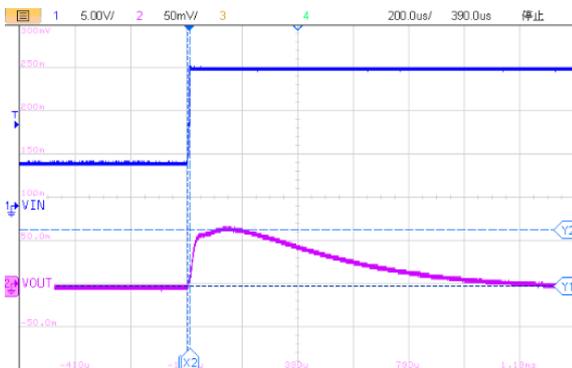
Output Voltage VS Output Current



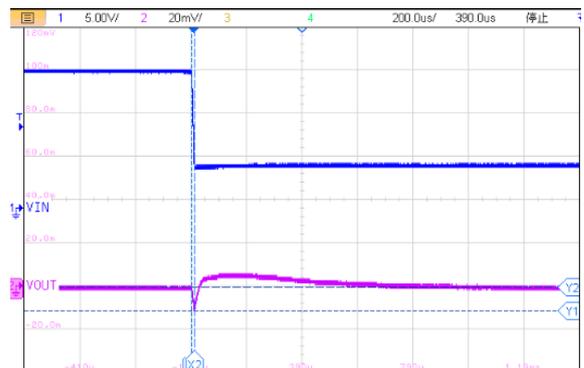
PSRR @ IOUT=20mA



Ton @ IOUT=20mA



Input Transient (5.3~16V t=10µs 1mA)

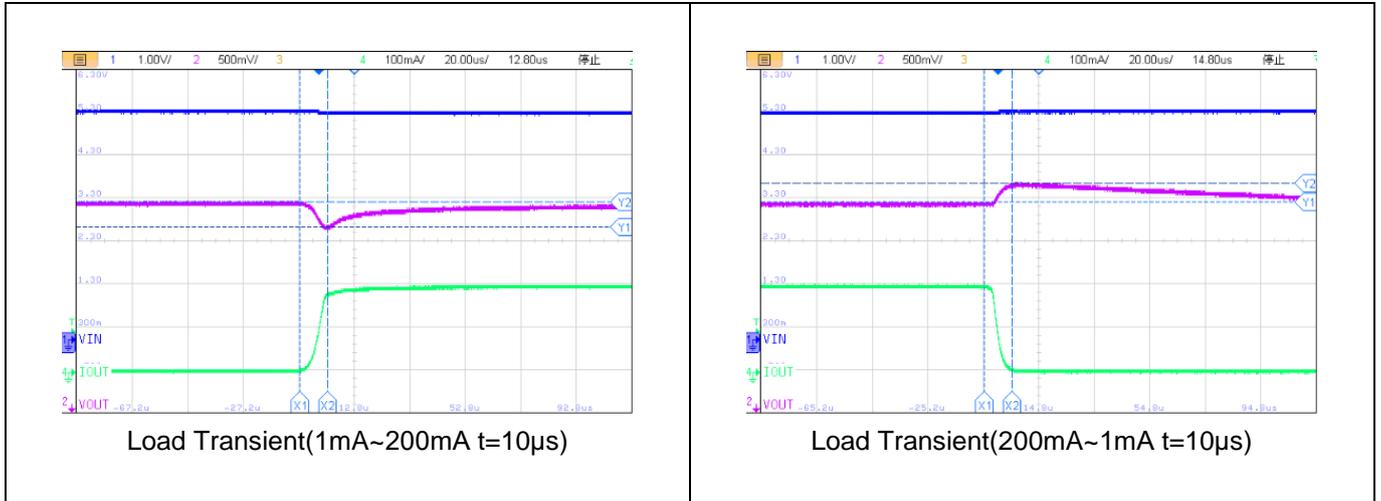


Input Transient (16~5.3V t=10µs 1mA)

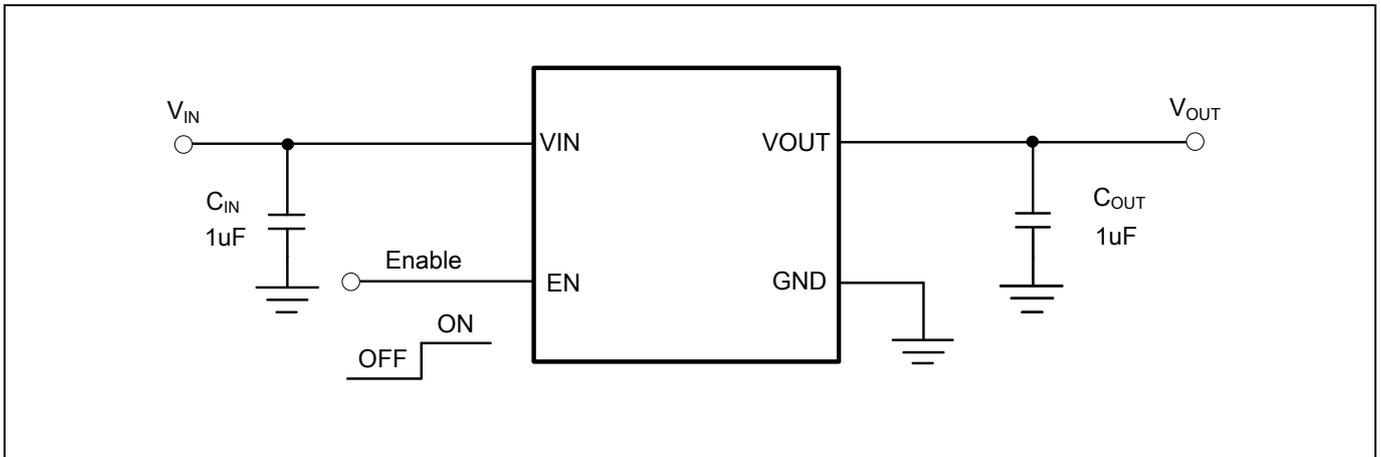
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Typical Characteristics (Continued)

($V_{IN} = 5.3V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)

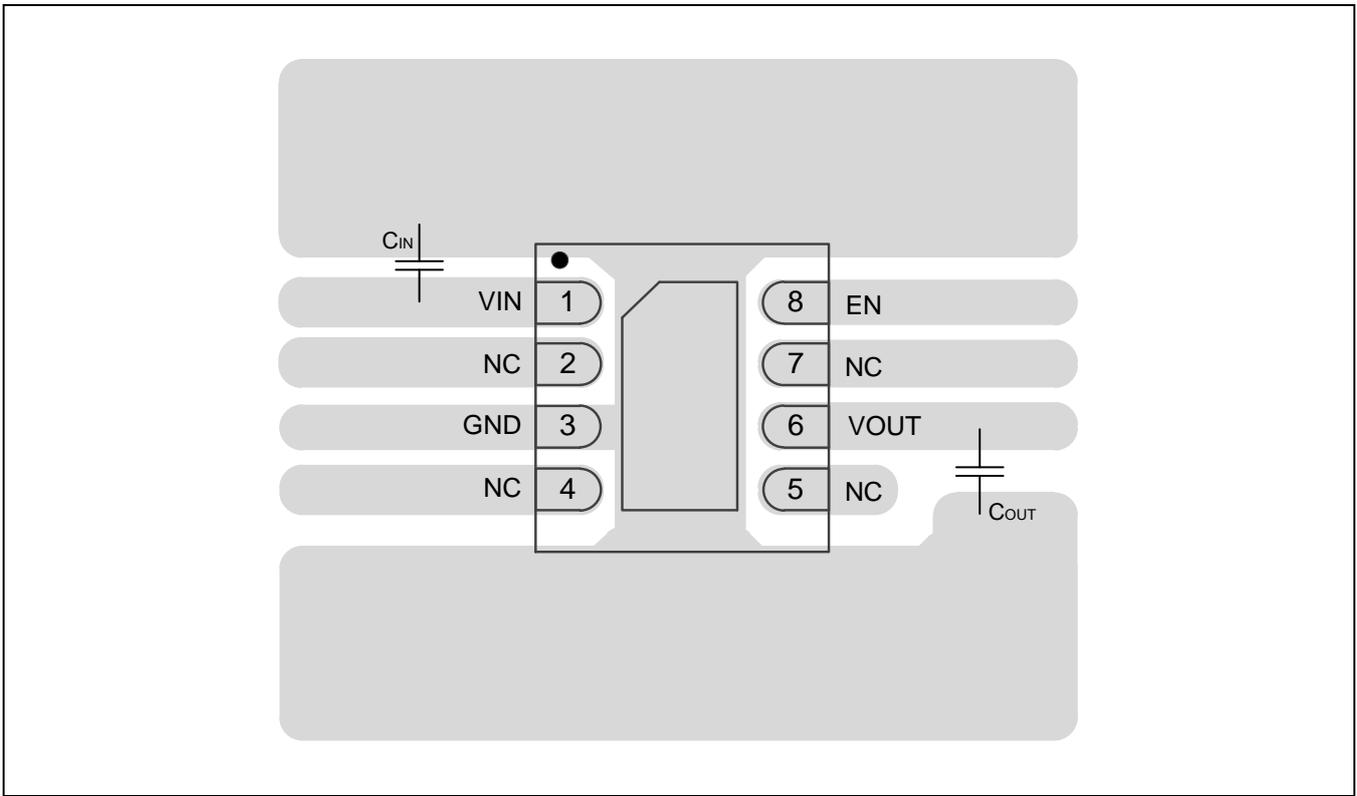


Application Circuits

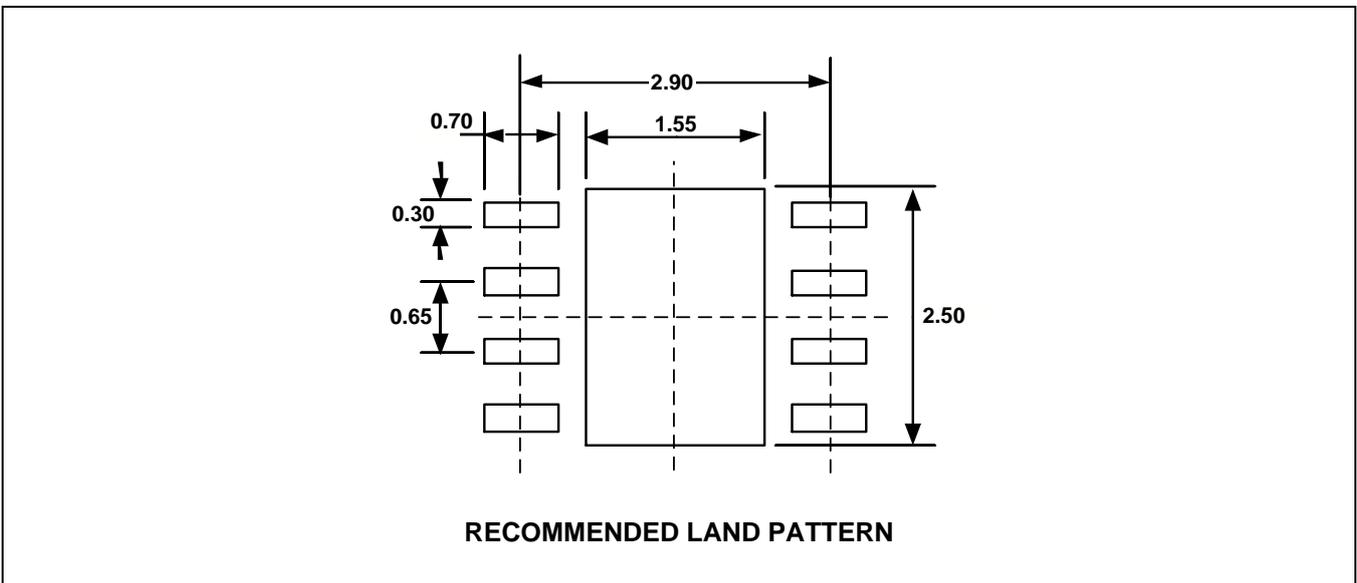


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PCB Layout Guide



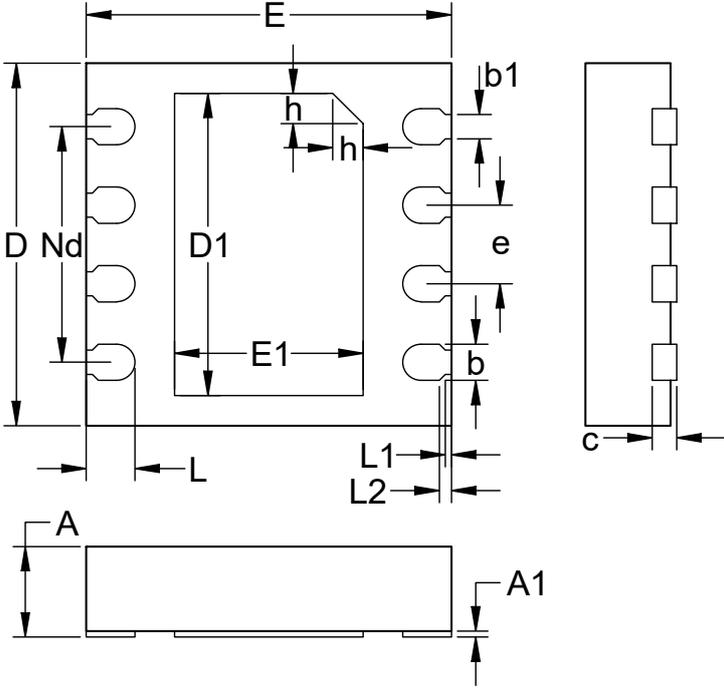
PCB Land Pattern



ETQ6H333Y

Package Dimension

DFN8(3×3)

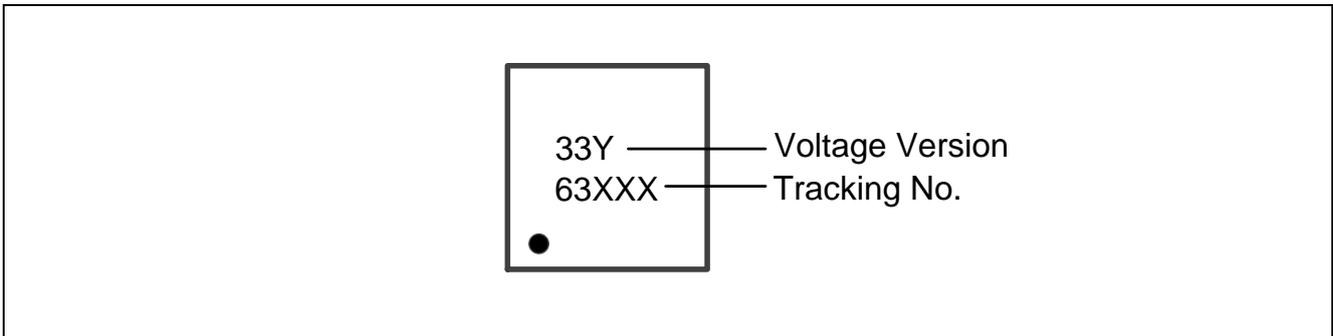


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

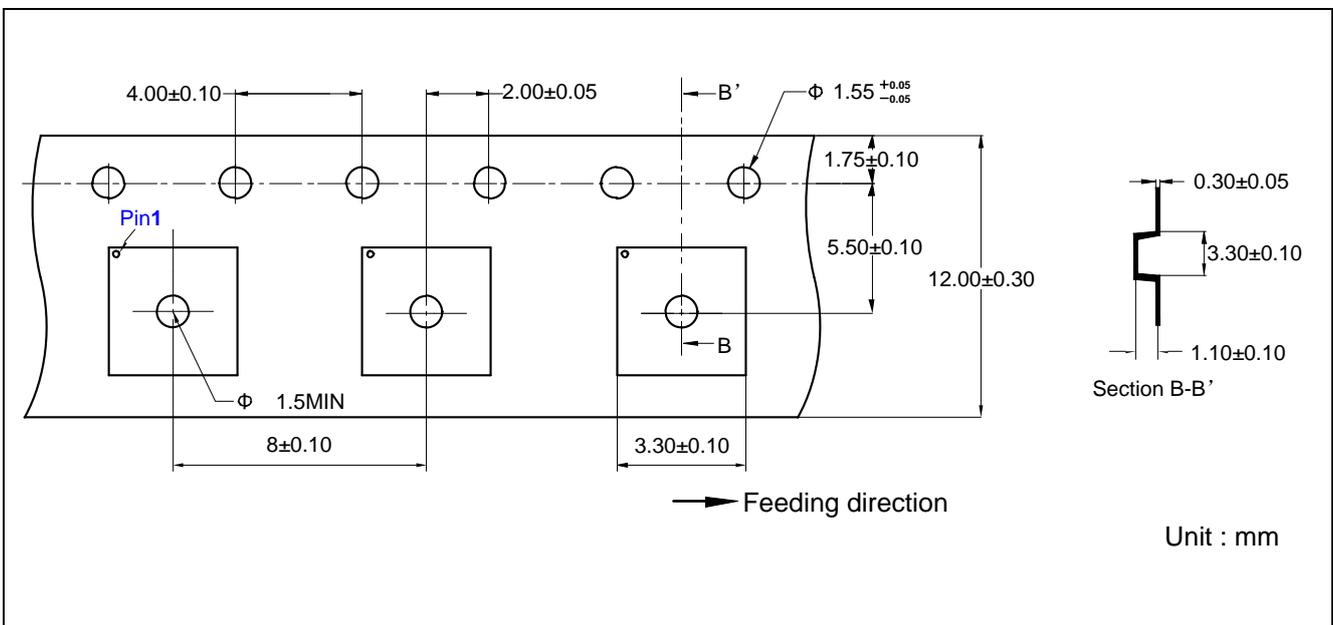
SYMBOL	MIN	NOM	MAX
A	0.70	-	0.95
A1	0.00	0.02	0.05
b	0.25	0.30	0.35
b1	0.20REF		
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D1	2.40	2.50	2.60
e	0.65BSC		
Nd	1.95BSC		
E	2.90	3.00	3.10
E1	1.45	1.55	1.65
L	0.30	0.40	0.50
L1	0.05REF		
L2	0.10REF		
h	0.20	0.25	0.30

ETQ6H333Y

Marking



Tape Information



ETQ6H333Y

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023-7-21	Preliminary Version	Pengjj	Liuxm	Liuju
1.0	2023-10-17	Official Version	Pengjj Yangxx	Liuxm	Liuju
1.1	2023-12-06	Update Typical Characteristics	Pengjj	Liuxm	Liuju