

Low Voltage 1.0Ω Max Dual SP3T Switch

With Break Before Make Feature

General Description

The ET3856 is a high-speed CMOS low voltage dual analog SP3T (Single Pole Triple Throw) switch or Dual 3:1 Multiplexer/Demultiplexer Switch fabricated in silicon gate CMOS technology. It is designed to operate from 1.65V to 4.3V, making this device ideal for portable applications.

The device offers very low ON-Resistance ($<1.0\Omega$) at $V_{CC} = 4.3V$. The disabling and enabling of switches are done by setting the IN1 and IN2 control pins. Additional key features are fast switching speed, and Ultra Low Power Consumption. All inputs and outputs are equipped with protection circuits against static discharge, giving them ESD immunity and transient excess voltage.

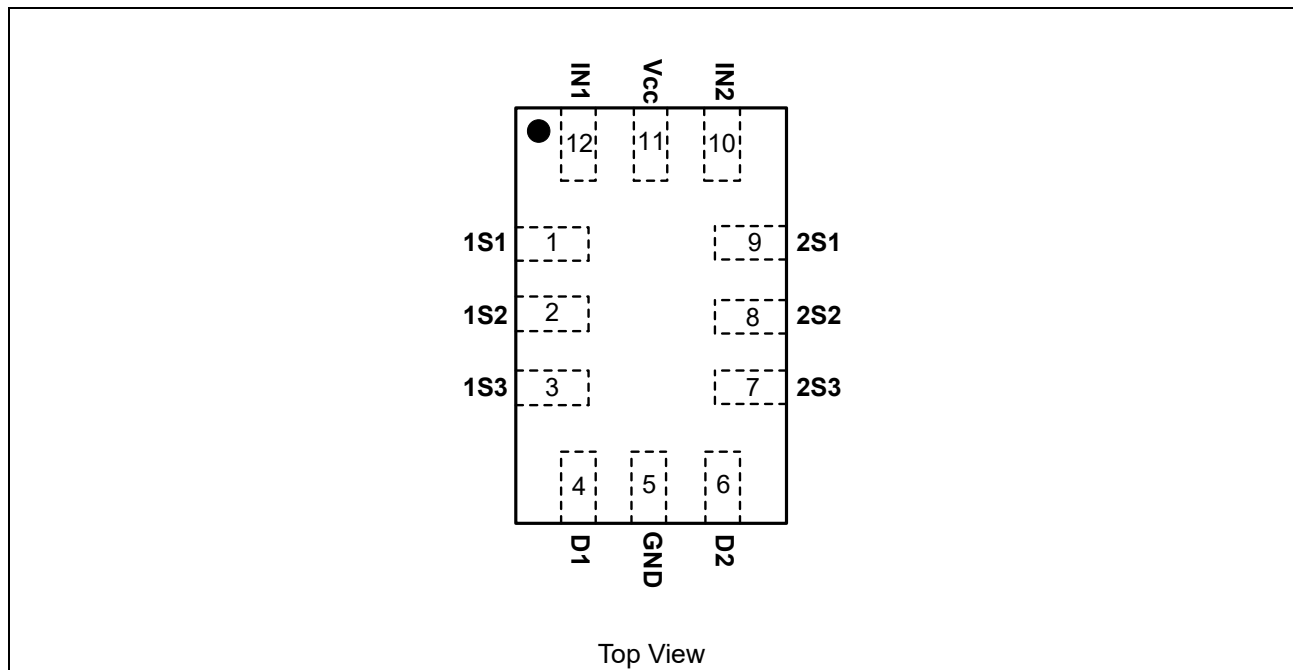
Features

- High Speed:
 - $t_{PD} = 0.3ns$ (TYP.) @ $V_{CC} = 3.0V$
 - $t_{PD} = 0.4ns$ (TYP.) @ $V_{CC} = 2.3V$
- Ultra Low Power Dissipation:
 - $I_{CC} = 0.2\mu A$ (MAX.) @ $T_A = 85^\circ C$
- Low "ON" Resistance $V_{IN} = 0V$:
 - $R_{ON} = 1.1\Omega$ (MAX. $T_A = 25^\circ C$) @ $V_{CC}=4.3V$
 - $R_{ON} = 1.5\Omega$ (MAX. $T_A = 25^\circ C$) @ $V_{CC}=3.0V$
 - $R_{ON} = 1.8\Omega$ (MAX. $T_A = 25^\circ C$) @ $V_{CC}=2.3V$
- Wide Operating Voltage Range:
 - $V_{CC} = 1.65V$ to $4.3V$ Single Supply
- 4.3V Tolerant And 1.8V Compatible Threshold On Digital Control Input at $V_{CC} = 2.3$ to $4.3V$
- Latch-Up Performance Exceeds 300mA
- ESD Performance (Analog Channel. Vs. GND): HBM $>2kV$
- Part No. and package

Part No.	Package	MSL
ET3856	QFN12 (2.2 mm×1.4 mm)	Level 1

ET3856

Pin Configuration

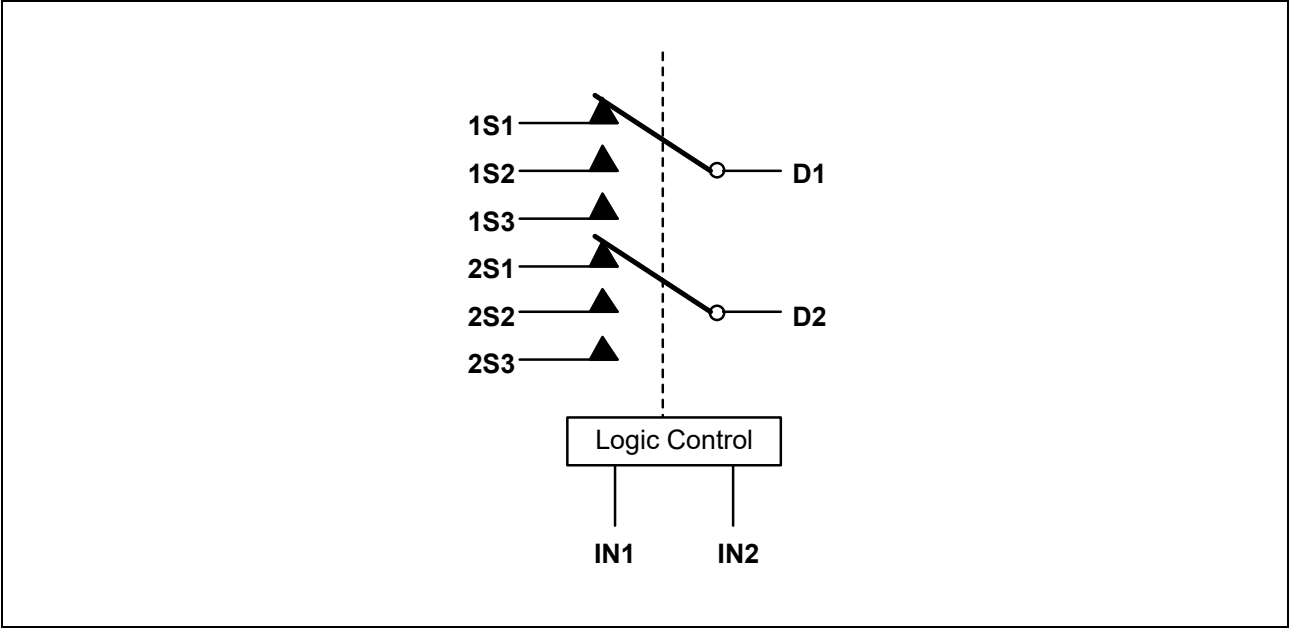


Pin Function

Pin No.	Pin Name	Description
1	1S1	CH1 Independent Channels
2	1S2	CH1 Independent Channels
3	1S3	CH1 Independent Channels
4	D1	CH1 Common Channels
5	GND	Ground Pin
6	D2	CH2 Common Channels
7	2S3	CH2 Independent Channels
8	2S2	CH2 Independent Channels
9	2S1	CH2 Independent Channels
10	IN2	Control Input Pin
11	V _{cc}	Positive Supply Voltage Pin
12	IN1	Control Input Pin

ET3856

Analog Symbol



Truth Table

IN1	IN2	Switch State
L	L	High-Impedance
L	H	D1-1S1, D2-2S1
H	L	D1-1S2, D2-2S2
H	H	D1-1S3, D2-2S3

ET3856

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to 5.5	V
V_I	DC Input voltage	-0.5 to $V_{CC} + 0.5$	V
V_{IC}	DC Control Input Voltage	-0.5 to 5.5	V
V_O	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IKC}	DC Input Diode Current on Control Pin ($V_{IN} < 0V$)	-50	mA
I_{IK}	DC Input Diode Current ($V_{IN} < 0V$)	± 50	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 150	mA
I_{OP}	DC Output Current Peak (pulse at 1ms, 10% duty cycle)	± 300	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 100	mA
P_D	Power Dissipation at $T_A = 70^\circ C$ ⁽¹⁾	0.25	W
T_{STG}	Storage Temperature	-65 to 150	$^\circ C$
T_L	Lead Temperature (10 sec)	300	$^\circ C$

Note1: Derate above $70^\circ C$ by 18.5mW / $^\circ C$

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	1.4 to 4.3	V
V_I	Input Voltage	0 to V_{CC}	V
V_{IC}	Control Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_A	Operating Temperature	-40 to 85	$^\circ C$
dt/dv	Input Rise and Fall Time Control Input	$V_{CC} = 1.65V$ to $2.7V$	ns/V
		$V_{CC} = 3.0$ to $4.3V$	

ET3856

DC Electrical Characteristics

Symbol	Parameter	Test Condition		T _A = 25°C			Unit
		V _{CC} (V)		Min	Typ	Max	
V _{IH}	High Level Input Voltage	1.65 - 1.95		0.65V _{CC}			V
		2.3 - 2.5		1.4			
		2.7 - 3.0		1.4			
		3.3 - 4.3		1.7			
V _{IL}	Low Level Input Voltage	1.65 - 1.95				0.40	V
		2.3 - 2.5				0.50	
		2.7 - 3.0				0.50	
		3.3 - 4.3				0.50	
R _{ON}	Switch On Resistance	4.3	V _S =0V to V _{CC} I _S =100mA		0.6	1.1	Ω
		3.0			1.3	1.5	
		2.7			1.5	1.8	
		2.3			2.0	2.2	
		1.8			2.5	3.0	
		1.65			3.3	4.0	
ΔR _{ON}	ON Resistance Match Between Channels	2.7	V _S @ R _{ON} Max I _S =100mA		0.01		Ω
R _{FLAT}	ON Resistance Flatness ^{(2) (3)}	2.7	V _S =0V to V _{CC} I _S =100mA		0.22	0.35	Ω
I _{OFF}	OFF State Leakage Current (nSN),(Dn)	4.3	V _S =0.3 or 4V			±0.5	μA
I _{IN}	Input Leakage Current	0 - 4.3	V _{IN} =0 to 4.3V			±0.5	μA
I _{CC}	Quiescent Supply Current	1.65 - 4.3	V _{IN} =V _{CC} or GND			±0.5	μA
I _{CCLV}	Quiescent Supply Current Low Voltage Driving	4.3	V _{IN1} ,V _{IN2} = 1.65V		±37	±70	μA
			V _{IN1} ,V _{IN2} = 1.80V		±33	±60	
			V _{IN1} ,V _{IN2} = 2.60V		±12	±20	

Note2: ΔR_{ON} = max |mSN-nSN|, where m = 1 and n = 2, N = 1..3

Note3: Flatness is defined as the difference between the maximum and minimum value of ON-resistance as measured over the specified analog signal ranges.

ET3856

AC Electrical Characteristics ($C_L = 35\text{pF}$, $R_L = 50\Omega$, $t_r = t_f \leq 5\text{ns}$)

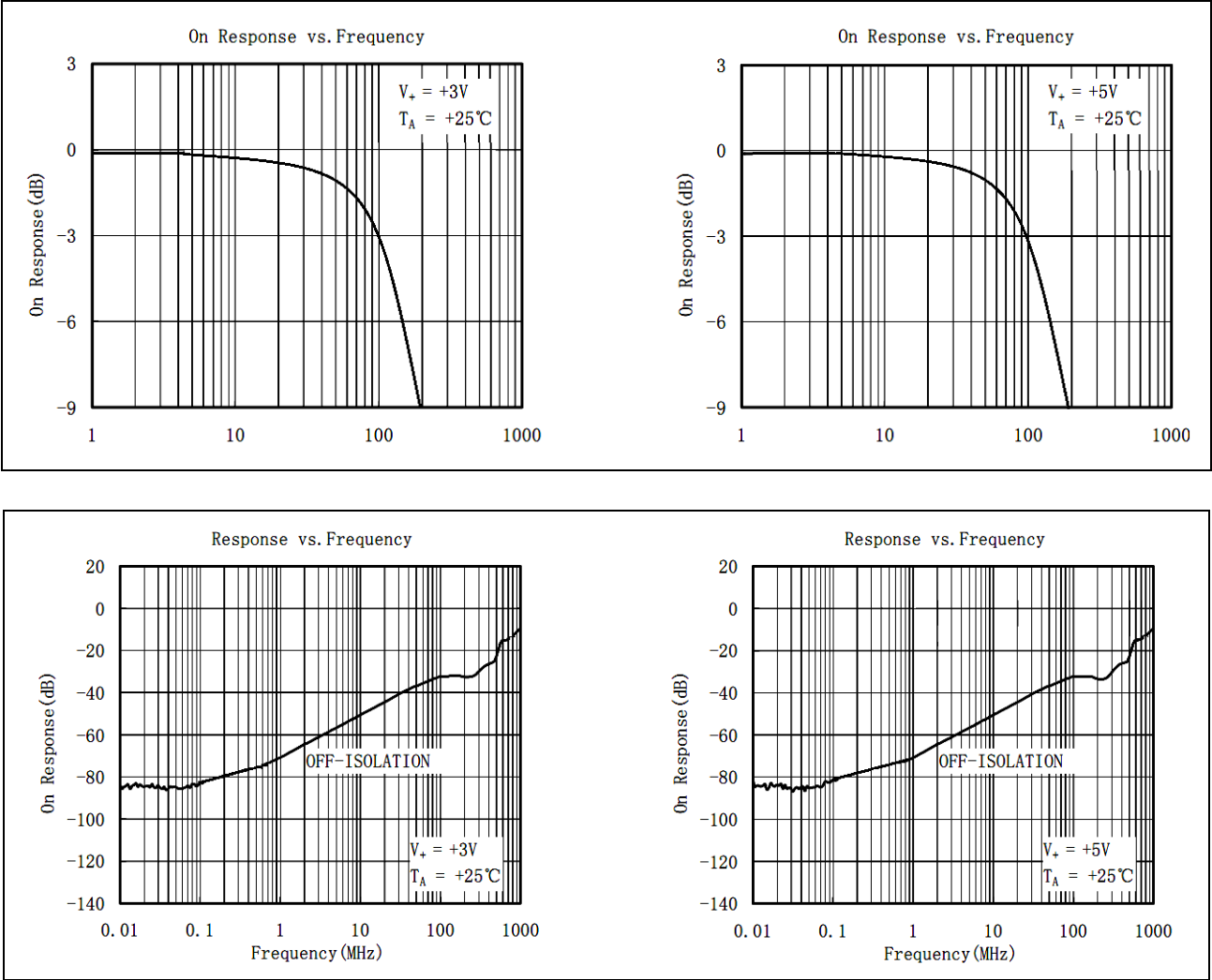
Symbol	Parameter	Test Condition		$T_A = 25^\circ\text{C}$			Unit
		V_{CC} (V)		Min	Typ	Max	
t_{PLH} , t_{PHL}	Propagation Delay	1.65 - 1.95			0.45		ns
		2.3 - 2.7			0.40		
		3.0 - 3.3			0.30		
		3.6 - 4.3			0.30		
t_{ON}	Turn-On Time	1.65 - 1.95	$V_S=0.8\text{V}$		56		ns
		2.3 - 2.7	$V_S=1.5\text{V}$		33	50	
		3.0 - 3.3			21	40	
		3.6 - 4.3			19	40	
t_{OFF}	Turn-Off Time	1.65 - 1.95	$V_S=0.8\text{V}$		24		ns
		2.3 - 2.7	$V_S=1.5\text{V}$		17	25	
		3.0 - 3.3			14	20	
		3.6 - 4.3			12	20	
t_D	Break Before Make Time Delay	1.65 - 1.95	$V_S=0.8\text{V}$	10	31		ns
		2.3 - 2.7	$V_S=1.5\text{V}$	10	22	40	
		3.0 - 3.3		10	18	30	
		3.6 - 4.3		10	7	25	
Q	Charge Injection	1.65 - 1.95	$C_L=100\text{pF}$ $R_L=1\text{M}\Omega$ $V_{GEN}=0\text{V}$ $R_{GEN}=0\Omega$		25		pC
		2.3 - 2.7			35		
		3.0 - 3.3			40		
		3.6 - 4.3			55		

Analog Switch Characteristics ($C_L = 5\text{pF}$, $R_L = 50\Omega$, $T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test Condition		$T_A = 25^\circ\text{C}$			Unit
		V_{CC} (V)		Min.	Typ	Max.	
O_{IRR}	Off Isolation ⁽⁴⁾	1.65 - 4.3	$V_S=1V_{RMS}$ $f=100\text{kHz}$		-82		dB
X_{TALK}	Crosstalk	1.6 - 4.3	$V_S=1V_{RMS}$ $f=100\text{kHz}$		-84		dB
THD	Total Harmonic Distortion	2.3 - 4.3	$R_L=600\Omega$ $V_{IN}=2V_{PP}$ $f=20\text{Hz to } 20\text{kHz}$		0.03		%
BW	-3dB、Bandwidth	1.65 - 4.3	$R_L=50\Omega$		50		MHz
C_{IN}	Control Pin Input Capacitance				5		pF
$C_{Sn(OFF)}$	Sn Port OFF Capacitance	3.3	$f = 1\text{MHz}$		23		
$C_{Sn(ON)}$	Sn Port ON Capacitance	3.3	$f = 1\text{MHz}$		70		
C_D	D Port Capacitance when Switch is Enabled	3.3	$f = 1\text{MHz}$		70		

Note4: OFF Isolation = $20\text{Log}_{10}(V_D/V_S)$, V_D = output, V_S = input at off switch

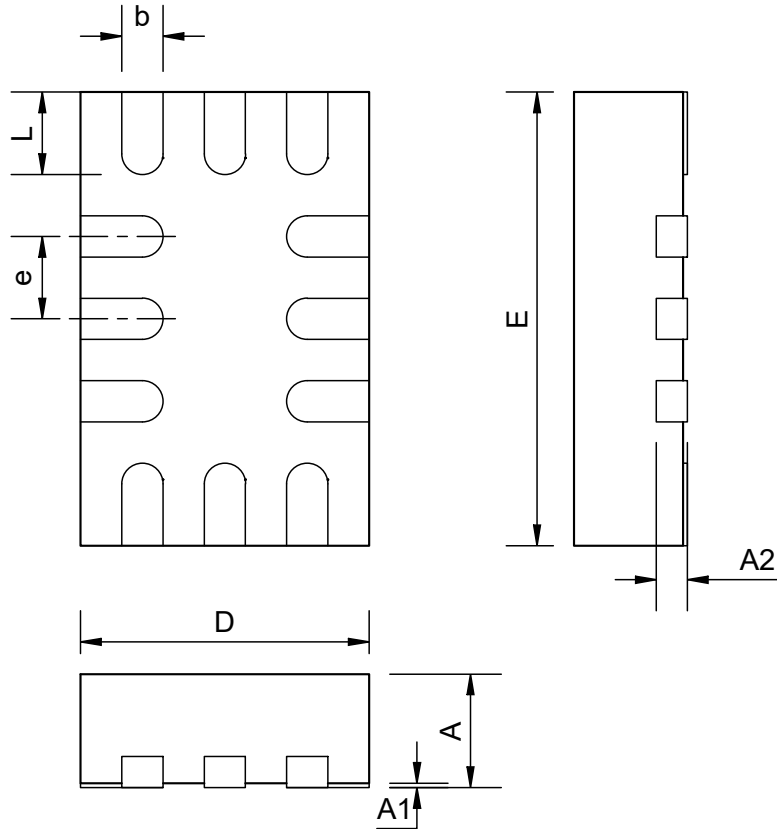
Typical Performance Characteristics



ET3856

Package Dimension

QFN12

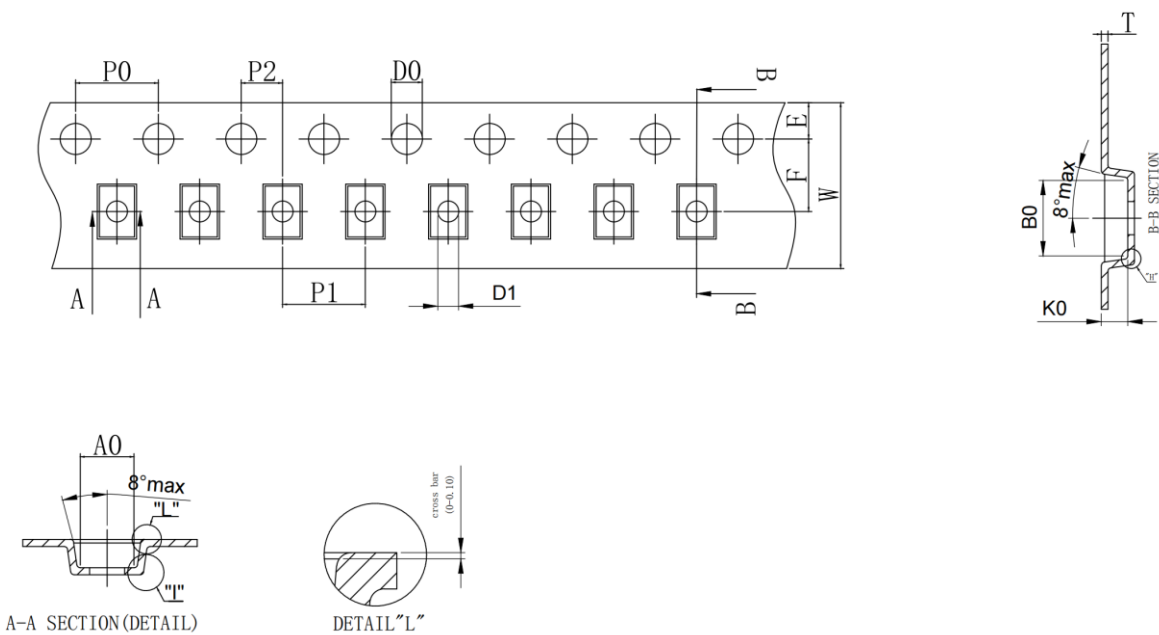


Unit : mm

SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0	-	0.05
A2	0.15REF		
b	0.15	0.20	0.25
D	1.35	1.40	1.45
E	2.15	2.20	2.25
e	0.4BSC		
L	0.30	0.40	0.50

ET3856

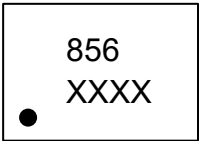
Tape



Items	A0	B0	K0	P0	P1	P2	T
Spec	1.70±0.10	2.45±0.10	0.80±0.10	4.00±0.10	4.00±0.10	2.00±0.05	0.20±0.02
Items	E	F	D0	D1	W	10P0	
Spec	1.75±0.10	3.50±0.05	1.50+0.10/-0.0	1.00±0.10	8.00±0.10	40.00±0.20	

Unit:mm

Marking Information



856 - Part Number

XXXX - Tracking Number

ET3856

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2016-09-09	Original Version	Liu Xiao Min	Liu Xiao Min	Zhu Jun Li
1.1	2017-04-28	Updated some parameters	Liu Xiao Min	Liu Xiao Min	Zhu Jun Li
1.2	2017-05-08	Updated V_{IH} & I_{CCLV} spec	Liu Xiao Min	Liu Xiao Min	Zhu Jun Li
1.3	2023-02-01	Update Typeset	Qinpl	Qinpl	
1.4	2023-4-23	Add Marking/Tape	Shibo	Wuxj	Liujiy