

MD2369AHX, HXV (DUAL)
MD2369AFHXV (DUAL)
MHQ2369HX, HXV (QUAD)
MQ2369AHXV (QUAD)

CRYSTALONCS
2805 Veterans Highway
Suite 14
Ronkonkoma, N.Y. 11779

NPN Silicon Dual/Quad Small-Signal Transistors

... designed for general-purpose switching and amplifier applications.

MAXIMUM RATINGS				
Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V _{CEO}	15		V _{dc}
Collector-Base Voltage	V _{CBO}	40		V _{dc}
Emitter-Base Voltage	V _{EB0}	4.5		V _{dc}
Collector Current — Continuous	I _C	500		mA _{dc}
		One Die	All Die Equal Power	
Device Dissipation @ T _A = 25°C	P _T	550 250 500 400	600 400 1500 600	mW
Derate above 25°C		3.14 2.0 2.86 2.28	3.42 2.28 8.58 3.42	mW/°C
@ T _C = 25°C		1.4 0.7 1.0 0.7	2.0 1.4 3.5 2.8	Watts
Derate above 25°C		8.0 4.0 5.71 4.0	11.4 80 20 16	mW/°C
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-65 to 200		°C



MD2369A
CASE 654-07
(TO-78)



MD2369AF
CASE 610A-04



MHQ2369A
CASE 632-08
(TO-116)



MQ2369A
CASE 607-04

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ⁽¹⁾ ($I_C = 10\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	15	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_B = 0$)	$V_{(BR)CES}$	40	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	40	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	4.5	—	Vdc
Collector Cutoff Current ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$) ($T_A = 150^\circ\text{C}$)	I_{CBO}	—	0.2 30	μA
Collector Cutoff Current ($V_{CE} = 10\text{ Vdc}$, $V_{BE} = 0.25\text{ Vdc}$) ($T_A = 125^\circ\text{C}$)	I_{CEX}	—	0.3 30	μA
Collector Cutoff Current ($V_{CB} = 20\text{ Vdc}$, $I_E = 0$)	I_{CES}	—	0.4	μA
Emitter Cutoff Current ($V_{BE} = 4.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	0.25	μA
ON CHARACTERISTICS				
DC Current Gain ⁽¹⁾ ($I_C = 10\text{ mA}$, $V_{CE} = 0.35\text{ Vdc}$) ($I_C = 30\text{ mA}$, $V_{CE} = 0.4\text{ Vdc}$) ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 100\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$, $T_A = -55^\circ\text{C}$)	h_{FE}	40 30 40 20 20	120 120 120 120 —	—
Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$) ($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = 125^\circ\text{C}$)	$V_{CE(sat)}$	— — — —	0.2 0.25 0.45 0.3	Vdc
Base-Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 30\text{ mA}$, $I_B = 3.0\text{ mA}$) ($I_C = 100\text{ mA}$, $I_B = 10\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = 125^\circ\text{C}$) ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $T_A = -55^\circ\text{C}$)	$V_{BE(sat)}$	0.7 — 0.8 0.59 —	0.85 0.9 1.2 — 1.02	Vdc
MATCHING CHARACTERISTICS (Duals Only)				
Base-Emitter Voltage Differential ($I_C = 3.0\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	$V_{BE1} - V_{BE2}$	—	5.0	mV
Base-Emitter Voltage Differential Gradient ($I_C = 3.0\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$)	$\frac{\Delta V_{BE1} - V_{BE2}}{\Delta T_A}$	—	10	$\mu\text{V}/^\circ\text{C}$
SMALL-SIGNAL CHARACTERISTICS				
Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 0.1$ to 1.0 MHz)	C_{obo}	—	4.0	pF
Input Capacitance ($V_{BE} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 0.1$ to 1.0 MHz)	C_{ibo}	—	5.0	pF
Small-Signal Current Transfer Ratio, Magnitude ($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 100\text{ MHz}$)	$ h_{fe} $	5.0	10	—

(1) Pulsed. Pulse Width 250 to 350 μs . Duty Cycle 1.0 to 2.0%.

(continued)

ELECTRICAL CHARACTERISTICS —continued ($T_A = 25^\circ\text{C}$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
SWITCHING CHARACTERISTICS				
Storage Time ($I_C = 10\text{ mA}$, $I_{B1} = 10\text{ mA}$, $I_{B2} = -10\text{ mA}$)	t_s	—	13	ns
Turn-On Time ($I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $I_{B2} = -1.5\text{ mA}$)	t_{on}	—	12	ns
Turn-Off Time ($I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $I_{B2} = -1.5\text{ mA}$)	t_{off}	—	18	ns

ASSURANCE TESTING (Pre/Post Burn-In)				
Characteristics Tested	Symbol	Initial and End Point Limits		Unit
		Min	Max	
Collector Cutoff Current ($V_{CE} = 20\text{ Vdc}$)	I_{CES}	—	0.4	μA
DC Current Gain ⁽¹⁾ ($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	h_{FE}	40	120	—

Delta from Pre-Burn-In Measured Values		Min	Max	
Delta Collector Cutoff Current	ΔI_{CES}	—	± 100 or ± 25 whichever is greater	% of Initial Value nA
Delta DC Current Gain ⁽¹⁾	Δh_{FE}	—	± 15	% of Initial Value

(1) Pulsed. Pulse Width 250 to 350 μs . Duty Cycle 1.0 to 2.0%.